PB-225 521

LAND USE AND THE ENVIRONMENT: AN ANTHOLOGY OF READINGS

WASHINGTON ENVIRONMENTAL RESEARCH CENTER

MAY 1973

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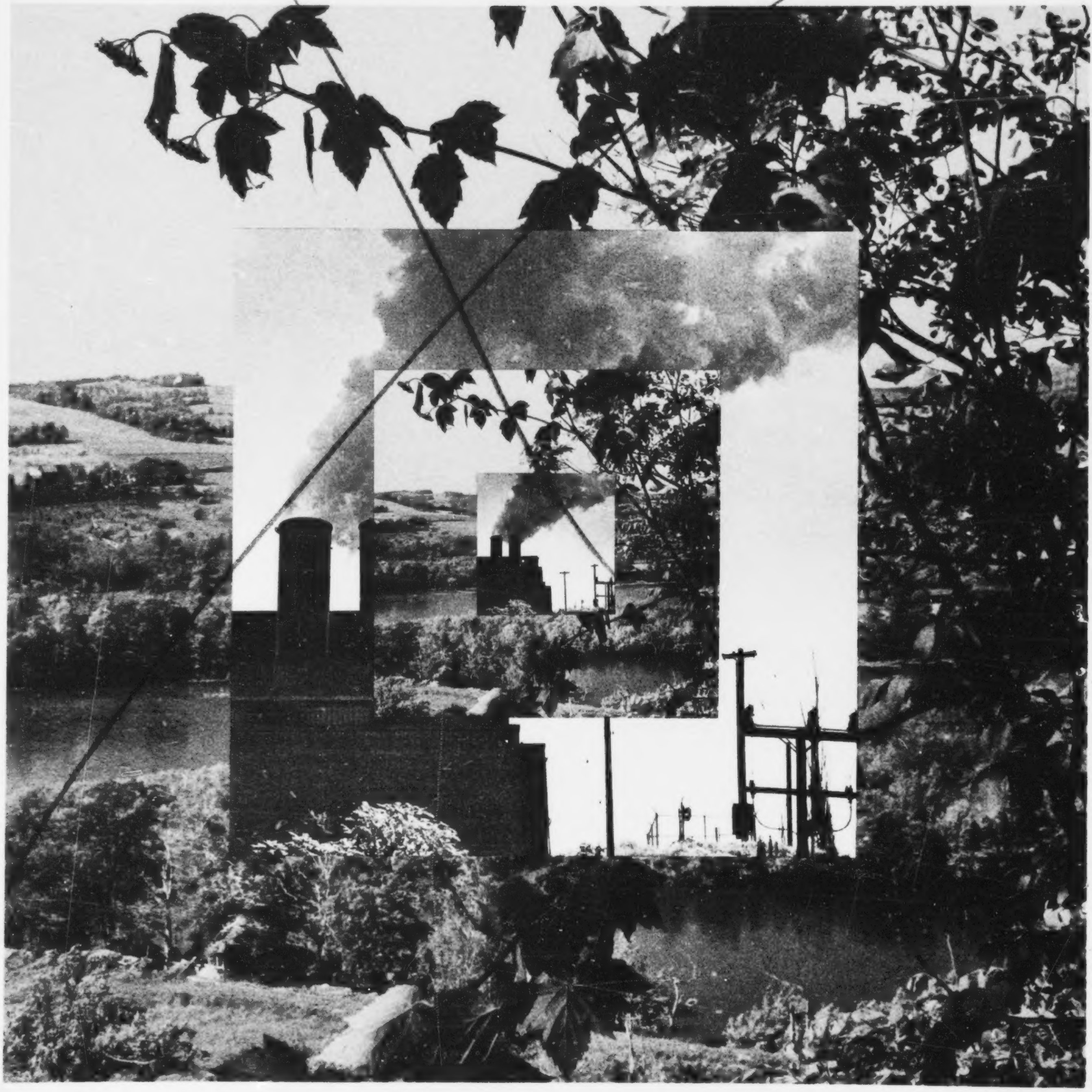
Environmental Protection Agency
Office of Research and Monitoring
Environmental Studies Division

Land Use and the Environment

An Anthology of Readings



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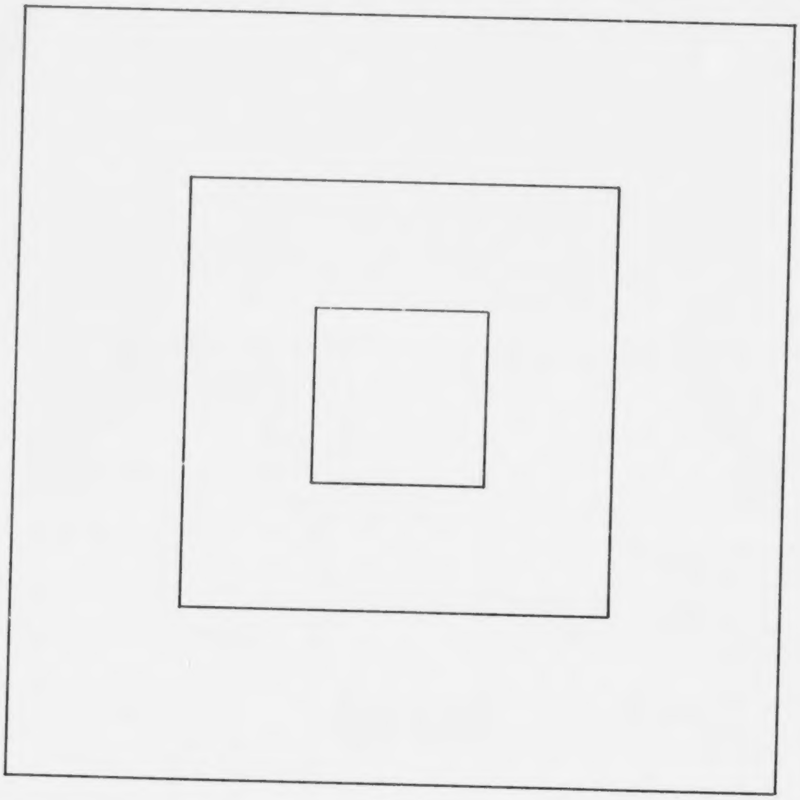
Land Use and the Environment

An Anthology of Readings

Prepared by the American Society of Planning Officials, Chicago, Illinois, under the auspices of The Environmental Studies Division of the Office of Research and Monitoring, The Environmental Protection Agency, Washington, D.C.

Virginia Curtis, editor



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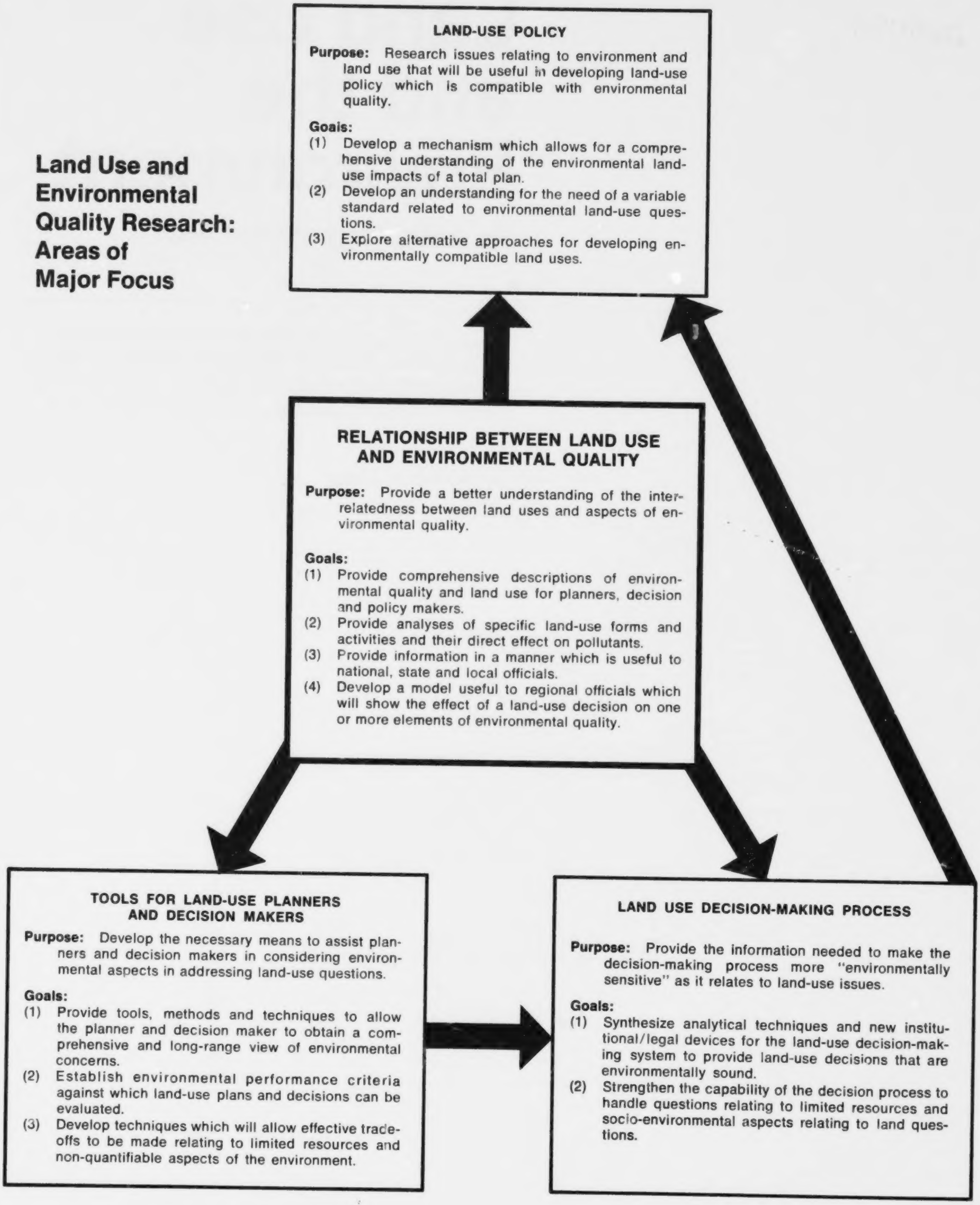
Land Use and Environmental Quality Research: Areas of Major Focus



LAND-USE POLICY

Purpose: Research issues relating to environment and land use that will be useful in developing land-use policy which is compatible with environmental quality.

Goals:

(1) Develop a mechanism which allows for a comprehensive understanding of the environmental land-use impacts of a total plan.

(2) Develop an understanding for the need of a variable standard related to environmental land-use questions.

(3) Explore alternative approaches for developing environmentally compatible land uses.

RELATIONSHIP BETWEEN LAND USE AND ENVIRONMENTAL QUALITY

Purpose: Provide a better understanding of the interrelatedness between land uses and aspects of environmental quality.

Goals:

(1) Provide comprehensive descriptions of environmental quality and land use for planners, decision and policy makers.

(2) Provide analyses of specific land-use forms and activities and their direct effect on pollutants.

(3) Provide information in a manner which is useful to national, state and local officials.

(4) Develop a model useful to regional officials which will show the effect of a land-use decision on one or more elements of environmental quality.

TOOLS FOR LAND-USE PLANNERS AND DECISION MAKERS

Purpose: Develop the necessary means to assist planners and decision makers in considering environmental aspects in addressing land-use questions.

Goals:

(1) Provide tools, methods and techniques to allow the planner and decision maker to obtain a comprehensive and long-range view of environmental concerns.

(2) Establish environmental performance criteria against which land-use plans and decisions can be evaluated.

(3) Develop techniques which will allow effective trade-offs to be made relating to limited resources and non-quantifiable aspects of the environment.

LAND USE DECISION-MAKING PROCESS

Purpose: Provide the information needed to make the decision-making process more "environmentally sensitive" as it relates to land-use issues.

Goals:

(1) Synthesize analytical techniques and new institutional/legal devices for the land-use decision-making system to provide land-use decisions that are environmentally sound.

(2) Strengthen the capability of the decision process to handle questions relating to limited resources and socio-environmental aspects relating to land questions.

BIBLIOGRAPHIC DATA SHEET

1. Report No.

2.

3. Recipient's Accession No. PB-225 521/4

4. Title and Subtitle

Land Use and The Environment: An Anthology of Readings

5. Report Date May 1973

6.

7. Author(s)

8. Performing Organization Rept. No. 62062

9. Performing Organization Name and Address

American Society of Planning Officials
1313 East 60th Street
Chicago, Illinois

10. Project/Task/Work Unit No. 1HA098

11. Contract/Grant No. R-802443

12. Sponsoring Organization Name and Address

Environmental Studies Division
Washington Environmental Research Center
Office of Research and Development
Environmental Protection Agency, Washington, D.C. 20460

13. Type of Report & Period Covered Interim

14.

15. Supplementary Notes

16. Abstracts

This document offers a selection of 24 readings in the areas of land use and environmental quality and emphasizes the vital link between these areas. The readings address the concepts of land use, the relationships between land use and environmental quality, national and state policies, incentives and controls, and potential future conflicts which may result from alternative future land uses. This anthology is intended to help those involved in shaping land use patterns to more fully appreciate the scope of their responsibilities.

17. Key Words and Document Analysis. 17a. Descriptors

Land Use, Environmental Quality, Land Use Planning, Land Use Policy

17b. Identifiers/Open-Ended Terms

Land Use and the Environment

17c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) UNCLASSIFIED

20. Security Class (This Page) UNCLASSIFIED

21. No. of Pages 192

22. Price 5.25

FORM NTIS-35 (REV. 3-72)

THIS FORM MAY BE REPRODUCED

USCOMM-DC 14952-P72

Comprehensive Planning Series
Volume One

Land Use and the Environment: An Anthology of Readings

This anthology is designed to offer a wide selection of high quality readings concerning current theory and practice of land use and environmental quality. This key relationship between our use of land and the quality of our environment should be understood by planners and policy makers at all levels of responsibility. Land use decisions are too crucial to our total environment to leave to the motivations of various interest groups. These decisions are long-range, often establishing patterns which endure for generations. The readings in this anthology will help those involved in shaping land use patterns to more fully appreciate the scope of their responsibilities. It will help them to exercise those responsibilities more fully in the interests of this and of future generations.

The series of which this anthology is the first volume is being produced under the auspices of the Comprehensive Environmental Planning Branch of the Environmental Studies Division, Office of Research and Monitoring, Environmental Protection Agency. This series is based on the knowledge that the capacity of our land and other resources to absorb our mounting pollution is being exceeded in too many areas. Air, water, and soil, as well as the aesthetic and other unique attributes of regions, are being over-extended. An approach to land use is needed which takes into account the capability of the total environment to accommodate and absorb the results of various land use pressures. A systematic and interdisciplinary approach must be developed for and communicated to those policy planning and decision-making processes which affect all aspects of the environment.

The current planning and land use decision-making techniques will be assessed in this series to determine their sensitivity to environmental concerns. This effort will examine environmental carrying capacity and systematically relate such technology to developing policy, planning, and decision-making tools, methods and techniques which are effective in meeting new environmental goals and objectives. By providing the necessary understanding and capability to policy makers, planners and others, environmental problems can be dealt with before they become crises.

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Foreword

> "As we steadily bring our pollution problems under control, more effective and sensible use of our land is rapidly emerging as among the highest of our priorities."
>
> *President Nixon, February 19, 1973*
> *Report on the State of Our Natural Resources*

The quote above, emphasizing interest at the highest national policy level on the subject this anthology addresses, suggests that in the future the energies of policy-makers will be focused on the problems of land use and the relationship between land use and our future environment.

Recently we have come to realize that land is, indeed, a limited resource. The last frontier--the one in our minds that saw land as a limitless resource and assumed that greener pastures lay beyond every range of hills--this frontier is dissolving.

We are now reaping the harvest of earlier, indiscriminate land-use patterns. We are coming to realize that our ability to deal with the symptoms of today's environmental crises is shackled by yesterday's land-use practices. For example, the urban sprawl which evolved in the Los Angeles area is apparently complicating efforts to control air pollution.

Man has been "studying" land use, especially as it relates to agriculture, for centuries. He has experimented time and time again with direct and indirect ways of making the land more fecund. For our purposes, we focus on research done during the last few decades when multiple stresses have developed in the form of expanded and sprawling urban growth. Some of our best minds have focused on this area and hundreds of millions of dollars have been spent in research and policy implementation. New forms of government were tested, new tax laws were suggested, dozens of studies were carried out. Suddenly the whole problem of metropolitan growth and suburbanization seemed to fade and we began to focus our attention on the central city. Here again, in addition to the human problems, we looked at questions of land use.

Now, as we go from the clean-up strategy to the prevention strategy in dealing with pollution, it is only natural that we should begin again to look at man's relationship to his land. In the hope that today's land-use plans and activities will not add to the environmental problems caused by previous efforts, The Environmental Studies Division, Office of Research and Monitoring, Environmental Protection Agency, is initiating research into the relationship between land use and environmental quality. The purpose of this effort is to improve the methodologies available to decision makers involved in land-use issues. Part of this effort has resulted in the following anthology--a series of papers reflecting some of the most useful writings in the field. This anthology is the first of a series of documents devoted to improving the "environmental sensitivity" of the decision-making and comprehensive-planning process.

Land Use: A Vital Link to Environmental Quality

The face and character of our country are determined
by what we do with America and its resources.

Thomas Jefferson

Land Use: A Vital Link to Environmental Quality

Martin J. Redding and B. Thomas Parry

Introduction

"Of all the factors that determine the quality of our environment, the most fundamental is the use we make of our land." This statement from the 1972 Report of the Citizen's Advisory Committee on Environmental Quality clearly emphasizes the critical relationship between the quality of our environment and the use which is made of our lands.

It is being increasingly recognized that the key to the protection and enhancement of our future environment is more effective land use planning and control. The radical changes in land use planning in some cities, the "quiet revolution" in land use controls taking place in many of our state environments, and the movement toward a national land use policy at the Federal level give evidence to this recognition.

In order to preserve our future environment it is essential that actions and decisions related to land use place environmental values on a level comparable to social and economic issues. This paper is undertaken to illustrate that land use is, in fact, a vital link to environmental quality. It consists of a general discussion of a range of issues relating to environmental quality and land use. This is followed by an examination of major land uses (agricultural, timber production, mining, recreational, and urban), their importance and the effect they have on environmental quality.

Overview

"Ecologically irresponsible land use practices and generally ineffective land use control--aside from the "Growth Ethic"--is the basic environmental problem facing America. Land use patterns are the generators, the root causes, of the environmental degradation symptoms of polluted air, polluted waters and other problems to which we have given infinitely more attention."[1]

Congress recognized the impact of man's activities on the natural environment when it established The National Environmental Policy Act of 1969. This evolving awareness at the national level is leading toward the development of a national land use policy bill which recognizes that a quality environment can be preserved through proper land use.

A speech by Senator Henry M. Jackson[2] stated that "Regulation and control of the land in the larger public interests is essential if real progress is to be made in achieving a quality environment. It is essential because the land is the key to insuring that all future development is in harmony with sound ecological principles and environmental guidelines."

This paper was prepared in the Environmental Studies Division, Office of Research and Monitoring, Environmental Protection Agency.

[1] Roger P. Hansen, A National Land Use Policy. Paper prepared for the Council on Environmental Quality.

[2] See Land Use in the United States, edited by Grant S. McClellan. The Reference Shelf, Vol. 43, No. 2. (New York: The H.W. Wilson Co., 1971.)

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The Council on Environmental Quality, established by NEPA, stated in its first annual report to Congress[3] that, "Misuse of the land is now one of the most serious and difficult challenges to environmental quality. . . ." In its second report to Congress[4] C.E.Q. states: "Land use decisions are an important determinant of environmental quality. Although planning and control of land use are largely the responsibility of local governments, the impacts of these activities often reach statewide, regionwide or nationwide."

In addition to recognizing the vital link between the quality of our environment and the use to which we put our land, the above sources also begin to acknowledge that the issues underlying land use and environmental quality are complex, have a wide range, and cut across all the fibers of our society.

Man brings about massive changes in his physical environment, and the activities or uses to which man places the land affect others and result in conflict. The effects are both direct and indirect and range from air, water, soil and noise pollution to social and psychological stresses.

The following illustrate the range of uses and subsequent environmental quality consequences:

1. Transportation systems affect air, noise, and water pollution, neighborhood social arrangements, aesthetic factors, and the general ecology. Dense development resulting from transportation systems, in turn, causes congestion, crowding, social stress, and other adverse factors.

2. Ski developments affect the wilderness, water supply and water runoff, and aesthetic factors, to name a few.

3. Results of mining operations include adverse aesthetic impacts, degradation of water quality and soil erosion.

4. Power plants affect air pollution, water pollution, and speculative land development.

5. Dense urban development results in increased congestion, crowding, high demands on energy and other resources, water and sewage facilities, poor aesthetic quality and socio-psychological effects relating directly or indirectly to noise, air pollution and meteorological conditions.

The complexity and diversity of the land use effects indicated in the above examples illustrate the importance of taking a comprehensive approach to land use and environmental quality issues. The approach which focuses on a specific environmental element in evaluating a proposed use of a parcel of land may result in minimizing particular impacts but may fail to recognize impacts on a number of other environmental factors with complex relationships.

Before discussing what can be done in the planning and decisionmaking processes to protect and improve environmental quality through land use, it is useful to look at the ethic which has evolved with the growth of our country.

From the time of the first settlers man viewed the land and its elements as factors which he must conquer and control in order to survive in the new world. Furthermore, it became more and more important to the individual that he be allowed to own his own piece of land. This feeling combined with the government's need to have land developed to supply goods reinforced the concept of private land ownership. In addition, once an individual owned his land he could use it as he wanted. The ethic that evolved in the United States is one that has viewed the ownership and use of a parcel of land as a private matter.

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[3] Environmental Quality: The First Annual Report of the Council on Environmental Quality. (Washington, D.C.: CEQ, 1970.) P. 165.

[4] Environmental Quality: The Second Annual Report of the Council on Environmental Quality. (Washington, D.C.: CEQ, 1971.) P. 19.

In a paper prepared for the Council on Environmental Quality, Roger Hansen asserts: "This 'Frontier Ethic' is not largely different from the attitudes most Americans have about land today: a commodity to be possessed, exploited, conquered."[5] He further states that,

> America lacks a land ethic which generates consumer demand for housing developments which are sensitive, responsible and responsive to the social needs of humans and the organic needs of nature. It lacks an ethic which its political leaders can utilize to enact appropriate legislation and control mechanisms to direct and promote proper growth. It lacks an ethic upon which the lending and financial institutions can make judgments, not only as to economic viability of a development, but also as to the environmental appropriateness of that development. And it lacks an ethic upon which the planning, design and construction professions can generate innovative plans compatible with the carrying capacity of diverse, sensitive and beautiful ecosystems. It lacks an ethic which recognizes that everything affects everything else.

This "Frontier Ethic" has pervaded our past thinking and actions. Nevertheless, we have recognized, to a limited extent, that activities on a parcel of land can affect adjacent property. Past techniques such as conditional fees and covenants combined with the more recent devices such as zoning and subdivision regulations give evidence to this recognition. However, the effects as perceived in the past are reflected in the following objectives of zoning: (1) protection of property values by requiring uniformity in each district; (2) exclusion of dangerous and nuisance uses from residential districts; (3) prevention of the overexploitation of land and the reduction of building density; (4) fostering public service efficiency, e.g., preventing overcrowding at locations nearest transit facilities.[6]

In addition to not recognizing the enhancement and protection of environmental quality as an objective, zoning and other land use controls have resulted in adverse consequences, including: (1) the separation of people from employment opportunities; (2) the straining of transportation facilities and indifference to the relationship of land use and traffic; (3) the distortion of the tax bases; (4) the promotion of monotony; (5) the encouragement of poor architectural and site design; (6) the frustration of areas with sewer, water, and public facilities systems; (7) the administrative divorce of controls from planning; (8) the decrease of housing supply for the poor and an increase in its price; (9) the encouragement of tinkering with the mechanics of the various land use controls "to prevent this or that from happening [while] the broad picture is sometimes blurred in the process."[7]

The increasing pressures placed on a limited supply of land combined with an evolving new land ethic highlights the importance of identifying and describing the social, economic, and environmental effects associated with specific land uses. Developing policy and controls need to address the environmental and ecological consequences of land use activities on surrounding areas. The way property is used should be a public concern when activities on the land have significant effects on adjacent property. By shifting the emphasis of concern for land uses to the performance of a specific use, we can begin to have better control over adverse consequences and develop patterns of land use which are compatible with the environment as well as with adjacent activities.

Land use planning and control has been concerned with environmental problems for some time, though mostly at a very limited level, for example, the neighborhood effects of noise, fumes and smoke. Today, however, environmental problems extend throughout our urban regions and cross state and national boundaries. The magnitude of the problem requires new approaches for land use planning.

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[5] Hansen, A National Land Use Policy, p. 3.

[6] Stephen Sussna, Land Use Controls. Urban Land Institute, Research Monograph No. 17, p. 6.

[7] Ibid., p. 7.

Planning for land use at all levels is one of the most important approaches for achieving environmental quality, and the information that planning provides is a key element for decisionmakers at each level of government. Certain planning approaches are more appropriate at one level than another. For example, performance standards, erosion control regulations, open space requirements, pollution control, urban design, renewal and historic preservation are of concern to all levels of government but are more appropriately dealt with by one specific level.

Unless meaningful and effective land use controls and planning techniques are used to assure that land use policies and plans are carried out to meet the new environmental problems, the result will be haphazard and reckless development and a continued degradation of the environment.

Significant actions are taking place at all levels of government which address the land use issues. At the Federal level steps are being taken to pass a National Land Use Policy Act.

States are beginning to pass land use legislation to implement land use policies and plans. The legislation of the state of Hawaii is a good example of what can be done in statewide land use regulation. The Hawaii Land Use Law of 1961 allows for implementing planning on a statewide basis. A Hawaiian state administration agency has the responsibility of designating broad basic land use categories (i.e., urban, rural, agricultural and conservation) for different parts of the state.

At the local level much needs to be done to assure that there is effective land use action that is compatible with state and national goals. The controls at this level should be specifically oriented to the unique problems of the area. They should cover an area of appropriate size, have an effective administrative structure, and be compatible with state controls. Again to use Hawaii as an example, the responsibility of local government is to provide detailed regulation shaping the character of the permitted uses. County land use control powers are being increased across the country but at a painfully slow pace. As the land use planning and control processes at this and other levels are accelerated every effort needs to be made to assure cooperation between each level of government.

As we move forward to tackle the land use issues from the policy to the daily decisionmaking levels, it is essential to understand what is happening to our environment as well as to understand why and how it is happening.

To comprehend the relationship between the uses to which we put our land and their effect on the environment, it is important to understand the interrelatedness of land ownership patterns, land management goals and techniques, and land use controls and how they, as the very basis for land use methods, affect the quality of the environment.

Land Use History

In order to gain a better insight into present attitudes and practices, an understanding of the history of the land use and the land use ethic is necessary.

The Indians were first to make their mark on the American landscape. Private ownership was not a concept in their society: "The idea that land could be bought and sold was an alien concept to the Indians of America. They clung possessively to certain chattels, but lands were nearly always held in common. An individual might have the use of a farm plot, but at his death it reverted back to the community."[8] The environment changed little under Indian stewardship.

The colonists from Europe had quite a different view. They had seen their society in Europe grow and transform with technological, political and social changes. Their experience had included land ownership by some and servitude by others. Though the feudal system was reaching its end, it was still very much in the minds of the settlers. Owning land was a measure of wealth and, to them, was an end in itself.

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[8] Stewart L. Udall, The Quiet Crisis. (New York: Avon Books, 1963.) P. 18.

The new world had a two-fold effect on the settlers. The forest and the wilderness represented a threatening force that had to be conquered if they were to feel secure; it also represented the great vastness and abundances of resources that the new land possessed.

The settlement patterns of the New England colonies and the southern colonies give an insight into what was to come. In New England when a group of settlers wanted to establish a new town they first obtained permission from the government and then surveyed and prepared titles for the land. They established a common grazing and meeting ground and built their houses around that area. They cleared the land collectively and divided it up evenly by family. Such settlements had little or no land speculation. Agriculture was the concern of the entire town and was not the domain of a few large landowners.

The southern colonial establishment was quite different. Each man that settled in the colony received 50 acres (called a headright). Those given headrights could select their location. Surveying and the issuing of land titles were ignored and thus land speculation became common practice. Headrights could be bought and sold. This led to the assembling of lands into the large plantations so evident in the south later in the century. The southern colonial methods and ethic prevailed.

As the colonies developed they claimed western land that was yet unsettled. The first controls imposed by state governments began in the colonial period, including state government taxation of land, taking of private land for public purposes and regulating laws on inheritance of land.

The Revolution had a great effect on evolving settlement patterns in the United States. The new government was faced with heavy debts from the war and depreciated currency. When the Union was formed, the colonies claiming vast quantities of land to the west gave up their claims to the Federal government. It is important to note that at the very basis of the new government was the firm belief in private property. The question at the time wasn't whether, but how, the government should dispose of its land to private citizens.

Land Disposal

The first method of disposition of public lands was through land sales, which became a main source of revenue for the government. In the 1820s the sale of land led to a high level of economic speculation. Land speculators at this time wanted to accumulate large tracts of land along the Atlantic coast where values would be highest. The settlers were more interested in the government opening and selling land in the western areas.

Settlers began moving west faster than the government could survey and put the land up for sale, and they were given priorities in the pre-emption act of 1841. This act allowed the settlers to buy land on which they had already settled for $1.25 per acre.

Land grants were also an important means of disposing of the federal lands. Grants were given to support public education. Also, lands were given to the state.

> Another type of land grant was of swamp and overflow lands, given to states for the purpose of land improvement. This was based on the assumption that the states would be better equipped to improve those lands than the federal government. The states were in fact much less well placed to undertake the large capital expenditures needed for extensive land reclamation. A great deal of valuable cropland, subject to occasional overflows, was given to states in this way; often the states sold this land at very low prices to land speculators with political influence. Much of the central valley of California and the Mississippi Delta went this way; the acreages involved were substantial.[9]

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[9] Marion Clawson, The Land System of the United States. (Lincoln: The University of Nebraska Press, 1963.) P. 61.

Land grants were also made for various modes of transportation. Grants for roads at this time were small, but lands granted to the railroads were substantial. The government was more than generous with the railroads at this time simply because they felt it was the best way to settle the country.

The following acts were passed in response to increasing pressure on the government for free land:

> Homestead Act of 1862 - provided 160 acres of land free of charge to settlers; they had to reside on the land for five years before the title passed to them. Many settlers claimed pre-emption rights after six months, bought the land for $1.25 per acre, and then sold to land speculators.
>
> Timber Culture Act of 1873 - gave 160 acres of land to an individual if he would plant trees on one-quarter of the land.
>
> Desert Land Act of 1877 - provided 640 acres to a settler if he would irrigate one-eighth of it.

A series of land acquisitions accounted for the remaining land that was to make up the continental United States as it is today: Louisiana Purchase, 1803; Florida Purchase, 1819; Texas, 1845; Pacific Northwest, 1846; Pacific Southwest,1846; Alaska, 1867. These purchases gave the United States the land area it has today, with the exception of the extracontinental possessions.

Land Disposal Summary (in Millions of Acres)*

Total Land Area	1,904
Original Public Domain	1,442
Total Disposition, All Methods	1,031
Cash Sales, and Misc. Methods	300
Homesteads	285
Grants to States	225
Military Bounties and Private Claims	95
Railroad Grants	91
Timber Culture: Other Related Acts	35

*Source: Clawson, Land System of the U. S., p. 65.

The Land Ethic

It is important to understand the land ethic that was established in the U. S. As was mentioned earlier, there was never any question that land should not be privately owned. How the land was used was up to the individual, despite the early controls by state governments. Since land was plentiful and cheap a "use it up, throw it away" attitude was established. There was always more land, more trees, more water and more minerals. Land speculation became a common (and basically accepted) practice in our early history. Much of this attitude still prevails.

Growth was an early goal of the United States. It was important to settle the west quickly, and, thus, a plan for growth and settlement was not devised. Even after the western lands had been settled, the concept of "planned growth" was held in disdain.

Non-Urban Lands

The historical perspective just discussed is needed to gain a better insight into the way America uses its land today and the present land use ethic. A discussion of our major non-urban land uses (agriculture, timber production, mining and outdoor recreation) will give a clear picture of how present land use patterns in America affect the quality of our environment.

Agriculture

The prime factor in the development of the land disposition system in the United States was the need to develop a strong agrarian society. The Homestead Act of 1862 provided 160 acres of farm land to a settler if he would cultivate the land for five years. Only then did he receive title to the land.

There has always been the feeling in the United States that agriculture is the backbone of the economy. Farm ownership, size and percent of land area in farms has changed markedly and gives an insight into how our society has changed. In 1850 there were 1.5 million farms in the United States, 294 million acres in cultivation with an average farm size of 196 acres. This represented only 15.6% of our total land area.

In 1920 the number of farms had increased to 6.5 million, with a total acreage of 959 million acres. The average farm size, however, had decreased to 149 acres, while precentage of land in farm use had risen to 42.2%.

There was a marked change from 1920 to the late 1950s. In 1959 the number of farms had dropped to 3.7 million, but farm land area increased to 1,124 million acres--165 million acres over the 1920 level. The average farm size had expanded to 303 acres, while 49.5% of the United States' total land area was in farm use.

The trend has continued to fewer farms, with an increase in the average size. The family farm ownership pattern changed as large corporations have found the farming business more attractive.

With this shift in ownership, there has also been a shift in productivity. The small non-commercial farms are 1/3 of total number, but account for only 5% of total output, while the large commercial farms are only 10% of total number but produce over 50% of total output.

Cropland was heavily exploited from the colonial period through the early 1900s. "Exploitation of cropland continued unabated, perhaps increased, as settlement spread across the country. Some lands were more easily eroded than others, and, in some areas, wind was more of a threat than water. In nearly all areas, soils when first cleared had fertility stored up through forest or prairie use over the preceding centuries, which was quickly used up by cropping."[10]

On the land we are currently using, "there are still millions of acres from which soil losses are relatively great, and the steady erosion not only downgrades the land but causes both immediate and long term damage to streams and other water bodies. Wind also takes its toll."[11]

Even with our present intensity of agriculture we are not using all our best available soils for agricultural purposes. The three top classes of soils are defined: Class I--best soils; Class II--modest conservation practices needed; Class III--more intensive conservation practices needed.

In 1967 we were using only 75% of our Class I soils for agriculture, 60% of our Class II soils and 50% of our Class III soils.

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[10] Marion Clawson, America's Land and Its Uses. (Baltimore: The Johns Hopkins Press, 1972.) P. 101.

[11] Ibid., p. 103

Agricultural Chemicals--On agricultural lands, there has been increasing pressure to increase productivity, which has led to agriculture becoming a primary source of environmental deterioration. "The disturbing fact is that in terms of sheer volume of waste output, America's ranches, loggers and farmers--with a mighty boost from the manufacturers of agricultural chemicals--are far and away the worst polluters in the entire nation. Taken together, they are now (and probably always have been) responsible for more water pollution than either the cities considered as a whole or the rest of private industry combined."[12]

Agricultural chemicals (pesticides, insecticides, herbicides) are main contributors. These synthetic organic pesticides have the distinction of concentrating in fatty tissues as they move up the food chain. In one instance in Clear Lake, California, DDT residues were concentrated 100,000 times in the plankton-fish-bird food chain.

Synthetic organic pesticides are classified in four main groups:

1. *Non-persistent* (parathion, EPN) - last from a few days to several weeks before breaking down.

2. *Moderately persistent* (2, 4-D, atrazine) - last from one to 18 months before breakdown occurs; more dangerous.

3. *Persistent* (most chlorinated hydrocarbons - DDT, aldrin, dieldrin) - persist in environment up to 5 years.

4. *Permanent* - these are based on toxic inorganic elements such as mercury and lead; persist in the environment indefinitely.

The effect of these chemicals on the ecosystem is not completely known; certainly some are much more dangerous than others. However, it is known that some "pesticides have killed fresh and salt-water fish, contaminated marine invertebrates and threatened whole species of animals, including the bald eagle. That is only the beginning. Under laboratory conditions, some pesticides have been shown to produce cancers, birth defects and genetic mutation among rats, mice, hamsters, dogs and monkeys."[13]

It is difficult to say exactly how much (in total volume) pesticide, insecticide and herbicide is being used for agricultural purposes, but in 1968 the United States produced 1.2 billion pounds of synthetic organic pesticides. Eighty percent were used domestically, with agriculture being the heaviest user. The use of pesticides in our country is still growing at the rate of 15% per year. At this time there are approximately 900 types of pesticide in use in the United States.

Agricultural chemicals can enter an ecosystem in a number of ways. When application is by air, wind currents spread the chemical over a larger area than originally intended. The chemical then settles into streams and other bodies of water, as well as on land used for nonagricultural purposes, and are transported even further. In tests made in Antarctica, pesticide residues were found in animal populations where there had never been any direct application.

When chemicals are applied by ground-level machinery there is still some dispersion by air currents, but the heaviest concentrations are absorbed by the soil. In this case the chemicals are: (1) being absorbed by soil particles and washed into streams by rain or irrigation; (2) being leaked down through the soil and contaminating the ground water; and (3) persisting in the soil itself.

With the increase in the size of farms there has also been an increase in the acreage devoted to specific crops. Many large farms specialize in only one crop, rather than varied crops. Economically this may be desirable, but ecologically it can be quite dangerous. When the ecosystem is simplified in this way it is much less stable than normal. In diversity is stability. "The introduction of pesticides into the system simplifies it further by eliminating many competing species, often including those which prey on pests. With the natural system of control of numbers so completely disturbed, pest control becomes dependent on the use of chemicals. We become addicted to them."[14]

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[12] David Zwick and Marcy Benstock, Water Wasteland. (New York: Bantam Books, 1971.) P. 94.

[13] Philip Nobile and John Deddy, The Complete Ecology Fact Book. (Garden City, N.Y.: Doubleday & Co., 1972.) P. 293.

This leads us into a very dangerous cycle. Over time, as insect strains mutate and become resistant to the concentration of the chemicals being used, the farmer is forced to either increase the concentration, increase the frequency and amount of application or use a chemical that is more toxic (and many times more persistent). These alternatives all are very dangerous for the ecosystem.

There is also an added pressure on the farmer. American consumers have become accustomed to "perfect" food (e.g., no brown spots, insect damage, etc.) and this leads the farmer to pour more and more chemicals onto his land.

There has also been an increase in the use of nitrogen and phosphate fertilizer in recent years. Fertilizer can greatly increase yield per acre in many areas, but, in great quantities, can also cause problems. As the fertilizer is washed from the lands into the lakes and waterways it increases the nutrient level of the water, thus leading to a higher rate of eutrophication, higher turbidity level and a decrease in water quality. There have also been accusations raised recently that high levels of fertilizer act to destroy the bacteria that fix nitrogen, thus leading to the degradation of the natural fertility of the soil. This point is yet unproven.

The United States government has moved to control the use of some chemicals in the environment. The Department of Agriculture has banned the use of DDT, aldrin and dieldrin in aquatic environments. The Department of Interior has ceased using aldrin, dieldrin and 2,4,5-T on 356 million acres of Federal land. However, this represents only a fraction of the land on which chemicals are used today, and the list of banned chemicals is very short.

Other Environmental Problems--There are other environmental problems associated with agriculture of which many people are unaware. Agriculture is directly responsible for over 4 billion tons of sediment each year. For example, sediment losses from row-type farming has been as high as 70,000 tons per square mile per year. "Heavy siltation destroys aquatic life, damages industrial equipment (turbine blades, for example), and can more than triple drinking water treatment costs. When these solids settle, they clog harbors and shipping channels, and use up reservoir storage capacity. (It has been estimated that 20% of the nation's water supply reservoirs, numbering around 2,700, will have a useful life of less than 50 years at the present rate of siltation.) In some river basins--Washington, D. D.C.'s Potomac River, for example--sediment dwarfs the impact of all other pollutants combined."[15]

Soil particles are often saturated with pesticides, insecticides, herbicides and fertilizers, thus adding to the water contamination problem. It is interesting to note that it is projected that with present methods of soil conservation the sediment loss from our agricultural lands could be cut by up to 95%.

With the change in ownership and size patterns of farms and ranches, animal waste has become an alarming problem in the United States. In the past when cattle were on the open range and density was low, manure fell to the ground, decayed and wasn't a significant problem. With the shift toward holding pens and smaller and smaller land areas used for holding livestock, the problem has greatly increased.

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[14] Sterling Brubakes, To Live on Earth. (Baltimore: The Johns Hopkins Press, 1972.) p. 111

[15] David Zwick, Water Wasteland, p. 95.

In the United States today, there are 107 million cattle, 3 million horses, 53 million hogs, 26 million sheep and 490 million chickens. Together they produce over 1.7 billion tons of fecal waste. Unlike human sewage disposal, at the present time there is little or no treatment of animal wastes. The Interstate Commission Report on the Potomac River Basin in 1966 said, "Every time it rains. . . enormous amounts of animal wastes are washed from farmyards into the river, rendering it unsafe for swimming. . . . Although only a quarter-of-a-million people live in the river basin above Great Falls (just a few miles above Washington, D.C.), it has been estimated that the number of farmyard animals. . . . is the (waste) equivalent of a human population of 3.5 million. While most of the human population is served by some sort of sewage treatment plant, there is no comparable treatment for animal wastes."

As we are putting so much emphasis on controlling human sewage problems, it seems ludicrous to be doing nothing about the environmental problems of animal waste.

Water is the major limiting factor in agriculture, especially in the western United States. In the west there is a potential of 60-160 million acres of land that could be used for agricultural purposes. At the present time the United States Bureau of Reclamation has planned for 20 million acres of this land to be irrigated.

Though irrigation can vastly increase our agricultural production, there are also environmental problems associated with the use of water. The problems of sedimentation and pesticide contamination have already been mentioned, but there is another major environmental problem associated with agriculture--water salinity. As land is irrigated, the water percolates through the soil taking with it some solids (mostly salts). "Salinity, the most important water pollution problem in the Southwest, has been greatly aggravated by irrigation. . . . Once a river turns salty, the surrounding area ceases to be attractive to industry, since saline water is too corrosive to be used in industrial processes."[16]

Agriculture, of course, is vital to the United States. However, the health of the environment in our agriculture areas is equally important.

Timber Production

Importance--The forest resource is one of the most important to the economic and environmental stability of the United States.

It acts as a regulator of stream flow and water quality in that it greatly affects the amount of water runoff during times of heavy precipitation. In this way it minimizes soil erosion and moderates stream flow by acting to decrease peak flow during storm periods and increase flow during dry periods.

Forests also have an effect on climate, tending to deflect wind upward and influencing air temperatures inside the forest area. Temperatures have a tendency to have lower maximums and higher minimums inside the forest than outside.

Forage and cover for wildlife are also a function of the forest cover. The forest understory is of great importance as a provider of browse and cover for animals of all sizes.

Our timber lands, since World War II, have become a prime place for outdoor recreation. As population has increased, the amenity values provided by the forest have become more important and, thus, use has increased dramatically.

Wood products have also played a major role in the economic well-being of our country. Demand for wood products has risen steadily since World War II. By the early 1960s economic activities related to the timber industry accounted for over 6% of the gross national product. This increasing demand, of course, has profound effects on the way our timber lands are used.

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[16] Ibid., p. 99.

Development of the Forest Resource--When the colonists arrived in the New World, forest covered about one-half of the land area of the United States. It was the most tangible resource to the colonists, but the sheer vastness of its quantity led them to believe its supply would be inexhaustable. Since it was a renewable resource, the concept of inexhaustability flourished leading to the widespread destruction of large forested areas, especially in the eastern United States. Since there was no market for the resource, what the colonists didn't use in their houses or farms they simply burned.

As settlement moved west, and our country began to grow, land speculators began to realize the monetary benefit that the forests would bring and so "millions of acres passed into the hands of cattle syndicates, mining nabobs and speculators. The railroads were the real giants, receiving immense domains as 'encouragement' to finance construction. Something like half the nation's forests were plucked into private ownership."[17]

As the destruction and ownership changes of the forest continued, there became a growing concern about such practices in the late 1800s In 1897 the Organic Act was passed, establishing the National Forests for public ownership. However, at this time, no funds were set aside for administration and therefore the management was basically custodial in nature, i.e., stopping trespass cutting, extinguishing forest fires, etc.

Up and through World War II most of the timber produced in the United States was from private lands. Even in the late 1940s and early 1950s it was still a common practice for large landowners to denude their land of the forest resource, abandon or sell it and buy more forest land from the federal government. Even at this time the concept of inexhaustability was prevalent and forests were looked at only in terms of the value in board feet they could produce.

Ownership and Management-- In 1963 there were 743 million acres of forest land in the United States; 508 million acres were classified as commercial forest land (capable of producing a certain amount of cubic feet of wood per year). Non-commercial forest land occupied 235 million acres, or approximately one-third of the Nation's total. Three-fourths of America's timber land is in the east and correspondingly one-fourth in the west (most commercial hardwood species are in east and softwood species in west).

Private Ownership and Management. Private ownership in the United States today is quite varied. Because of early settlement patterns, much of private forest lands are in the east, however most of the large timber companies are located in the west.

Large Timber Company Ownership. Today approximately 73% of our forest land is in private ownership. The large corporate timber companies own a sizeable amount of land acreage, totaling about 65 million million acres, larger than the combined land area in the states of New York, Connecticut, and Massachusetts (International Paper Company, Weyerhauser and Georgia-Pacific being the largest owners of forest land). Yet, this area is only about 13% of the total forest land.

Management. Large timber companies are, as any company in the United States, concerned with making a profit. This is not to infer that they have no regard for what happens to their land; with the advent of the professional forester in the middle 1900s, these lands have been managed intensively for continuing production.

Silvicultural Systems. The key land use decision to be made in forest management is the silvicultural system to be used. Today there are two basic systems: clear cutting and selection cutting.

In the clear cutting method, various sized patches of land are denuded of their vegetation in harvesting and then either planted or allowed to be seeded by natural means. Some tree species (i.e., Douglas fir) need this kind of environment (large amounts of direct sunlight and bare mineral soil) to regenerate and prosper. The most important aspect is the size and location of the clear cut area.

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17. Land Use in the United States, edited by Grant S. McClellan, p. 127.

The other silviculture system is the selection system. The forest is managed for the maintenance of usually three classes of trees; periodically the area is harvested when the trees reach a specific size.

Management on lands owned by large timber companies is intensive as cutting cycles, silvicultural systems, application of fertilizers, pesticides and herbicides are calculated by a cost/benefit analysis. Many of these companies are working on the development of genetic "super trees" that will grow faster and yield better quality wood. Most have extensive seed bed systems for growing seedlings before transplanting. The intensity of management of management practices on these lands will increase as demand for wood products increases.

The Small Private Owner. Sixty percent of forest land is owned by small landowners, most of whom don't manage their lands for forest production at all.

Today there is a large number of owners (4 million) who own small areas of forest land (less than 100 acres each), yet this total area represents 24% of all forest land in the United States. Taken together, all the small landowners, of less than 5,000 acres each, own a total of 60% of the forest land in the U.S., yet they account for a very low output of wood products.

In 1969 Albert Worrel of Yale found that the small owners had a good proportion of better than average land quality and could produce up to 4 billion cubic feet of softwood per year. This figure represents about 40% of the total consumption today. On two-thirds of the small owners' land, timber is harvested occasionally but there is not any provision for future crops.

The problem the small landowner faces is basically that he does not have the background in forestry nor the time to pursue it as an economic objective. When he feels there might be enough timber on his land to harvest, he contracts the work out. More times than not he is taken advantage of by the harvester (interestingly enough called "gyppo loggers") whose economic gain is larger (proportionately) and logging practices questionable.

The low productivity from small privately owned timber lands puts more pressure on the larger timber companies to increase their output and therefore further intensifies their management practices.

Controls. Forest practices on private lands are strictly regulated in only a handful of states. In most areas they are subject only to federal and state water and air quality standards.

California provides an interesting example in the control of private forest land. In the 1940s the California Forest Practice Act established a committee to regulate management practices on private forest land. The act established a committee made up mostly of individuals that represented the timber producer's point of view. In 1972, the act was ruled unconstitutional by the California Supreme Court for two reasons: (1) specific standards were not set by the state legislature in the original act, and (2) the committee represented only one viewpoint. There are presently two bills in the legislature that rectify these two points. Even today, however, "there exists a feeling among some owners and operators that state regulation is too stringent and violates traditional private property rights."[18]

Federal Timber Lands. Public forest lands are concentrated mostly in the western United States and account for roughly 19% of all commercial forest land.

Management. Public forest lands have a different management orientation than private lands. In 1960, the Multiple Use and Sustained Yield Act was passed by Congress declaring that the national forests "shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes." It also directed the Secretary of Agriculture to manage the national forests for sustained yield and multiple use. The Multiple Use Act of 1964 gave the same direction to the Bureau of Land Management.

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[18] T. F. Arvola, "State vs. Local Forest Practice Regulations in California," Journal of Forestry, Vol. 68, No. 11, November 1970.

Basically, sustained yield means that timber growth should equal or be greater than timber cut. In 1962, the annual growth was 1.6 times the annual cut. It is projected by the year 1990 they will be equal.

The questions of dominant use versus multiple use is being raised more frequently today. The Multiple Use Act calls for use of national forests for a diversity of uses with no use precluding or being more important than another. In June of 1970, the Public Land Law Review Commission called for "dominant use" management on public lands: management of public lands should recognize the highest and best use of particular areas of land as dominant over other authorized uses." This would set aside particular areas of land for a primary use, and only allow other uses if they were compatible with that specified dominant use. Up to this point, Congress has made no move to call for a dominant use rather than a multiple use doctrine.

Since World War II, timber has increased in importance on our public lands and, correspondingly, its management has changed markedly. According to the public land law reviews commission's report, One Third of the Nation's Land: "Timber management on public lands has progressed over the past few decades from primarily fire protection to the point where a variety of techniques, including controlled fires, pesticides, herbicides, fertilizers, and mechanical equipment is used."

When timber is mature for cutting the Forest Service opens the harvesting operation for bid. They are, by law, required to accept the highest bidder, without taking into account other criteria.

The silvicultural system used on public lands has caused heated debate in recent years. Much of the public feels that the selection system should be used exclusively, as clear-cutting may not be compatible with other uses public lands are supposed to provide. In recent years the public has taken a new interest in the uses to which the federal government puts its forest lands.

Counteracting the public pressure on federal government management methods is the pressure the large timber companies are exerting. Some of these companies have over-cut their lands in an effort to meet the rising demand for wood products and are relying more heavily on public lands as a source of material. "In 1900 all the lumber used in the United States was cut from private lands. By 1950 about 15% was coming from public lands. Since then the ratio has steadily increased until now about 40% is from public lands."[19]

The Chief of the Forest Service said, "The softwood resources in private ownership are being overcut and any sustained increase in log harvest in the west must . . . come from public lands."

It seems likely that the Forest Service (as the largest timber land agency managing federal lands) has succumbed to industry pressure and, in essence, taken wood production as the dominant use on their lands. The University of Montana studied Forest Service management on the Bitteroot National Forest in Montana and found: (1) Multiple use and not the guiding factor; (2) consideration of values as watershed, soil, recreation and wildlife were secondary in priority; (3) present management practices for timber production could not be justified economically; (4) present harvest level was not leading to sustained yield; (5) multiple-use planning cannot be successfully undertaken because of budgetary limitations on staffing; and (6) there is not enough public involvement in Forest Service planning.

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[19] Gordon Robinson, "Responsible Forestry," Sierra Club Bulletin, Vol. 56, No. 10, December 1971.

Controls. The Forest Service itself decides when, how and how much timber should be cut on federal lands under their jurisdiction. "Operating under laws requiring that sustained yield and multiple use values be maintained on national forest lands, the agencies periodically measure the total inventory of timber in each of their working circles, their administrative units for timber management. They determine the amount, growth rates, and condition of timber; from their findings they then determine the 'allowable cut' for each working circle. Allowable cut is the amount of timber that can be sold annually under a timber management plan. It may be more or less than sustained yield."[20]

Essentially, the Forest Service establishes and controls its own management practices. However, it should be noted here that both public and private lands are subject to air and water quality laws.

Environmental Consequences of Timber Production--Water Quality. As pressure mounts to increase yield (as it has in agriculture) there is a turn to the increasing use of chemicals on the forest environment. In this environment, the chemicals have a tendency to find their ways into the water systems relatively quickly because of the increased run off rate of mountainous forest terrain. Fertilizers, herbicides, pesticides and insecticides are all being used on our forests today (both public and private). Dr. William Lawrence, who works for Weyerhauser, testified before a House Committee on Agriculture that his company needed to continue the use of 2,4,5-T (an herbicide) in their brush control program. This same herbicide has been banned on some federal lands. The same kinds of chemicals are being used on forest lands as agricultural lands, and thus can have the same results.

Clear cutting, if practiced in the wrong areas, can lead directly and indirectly to water quality problems. Stream flows can be altered drastically and sediments yields can increase markedly if clear cutting is not practiced with the utmost caution.

Logging itself is an inefficient process; unfortunately a better way of extracting the timber resource has not yet been devised. With present logging practices, limbs, tops and broken surrounding vegetation are left lying on the ground after logging is complete (basically for economic reasons).

In areas of heavy rainfall, this can be dangerous. The Pacific northwest is such a region. In an area owned by Weyerhauser, Crown-Zellerbach, Rayonier, and Georgia-Pacific there was heavy flooding in January of 1968. Many people believed that poor logging practices worsened the flooding. The rivers were blocked with debris, causing them to overflow their banks. In the summer of 1972, "the Washington State Department of Fisheries fined the Company (Weyerhauser) for hydraulic violations when masses of debris, left over from a logging operation on a tree farm, choked up Goat Creek in the same area. According to a fisheries department employee, "there were literally hundreds of similar violations all over the state, but we've just been forced to let most of them go by unchallenged."[21]

Logging roads have a tremendous impact on water quality. In their construction, they are a direct source of sedimentation but, more importantly, continue to be a constant source of sedimentation over time. The heavy precipitation in forest areas acts to continually erode the dirt logging roads. Since there is no overstory to intercept the rain and snow as it falls, the dirt roads receive heavy concentrations of precipitation and, thus, have high erosion rates.

The milling of logs itself is a producer of water pollution as bits of pulp and organic wastes are many times discarded directly into streams without any form of treatment.

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[20] Ibid., p. 84.

[21] Ibid., p. 95.

Air Quality. Sawmills have been a source of air pollution for many years as wastes from many sawmill operations are simply burned in large incinerators. This caused heavy air pollution problems in the Williamette Valley in Oregon where timber production is of major economic importance.

The application of fertilizers, pesticides and herbicides by air also causes air quality problems. At present this application method is being used both on lands owned by large timber companies and also on federal lands.

Aesthetics. Recreational use of our timber lands has increased greatly in the last 20 years and with this increase the public is more aware of the aesthetic value of the forest resource. Clear-cutting has come under fire for its effect on the aesthetic quality of the environment. Logging itself has come under attack for the same reason.

The Future--The timber production industry and the public are heading on a collision course. The industry sees increasing per capita demand, increasing population, decreasing land suitable for production and reacts with management techniques to improve productivity (clear-cutting, fertilizers, pesticides, etc.) that many times have detrimental effects on environmental quality. The public, because of increasing pressures in the city and more leisure time, is spending more of its time in the forest environment, becoming aware of the environmental problems created by timber production and reacting strongly in its desire to limit what the timber producer (both public and private) can do on and to the land.

Mining.

It was necessary that the new nation become established as a viable, ongoing colony before minerals could really play any role in colonial development. For this reason, they played a much different role in our early history than other resources.

As the discovery of new and different uses for mineral resources continued, so did the exploitation. With the invention of the cotton gin in 1793, the United States began its period of mechanization, and as the country became mechanized, exploitation increased rapidly.

The real exploitation of minerals started in the mid-1800s. One example was hydraulic mining for gold in California: "The result of the hydraulic mining was the massive movement of soil into the rivers that drained the Sierra Nevada. For every ounce of gold collected, tons of topsoil and gravel were washed into the river courses below. With the spring floods, clear streams became a chaos of debris, rocks and silt; communities downstream were inundated with muck, and fertile bottom lands were blanketed with mud and gravel. The town of Marysville along the Yuba River, was forced to build ever-larger levees that rose higher than the city's rooftops. In 1875, a big storm sent the Yuba over the levels and filled the city with silt."[22]

Oil was another mineral resource that was "raided." Large oil strikes occurred in the 1860s, and small oil boom towns (much like the boom towns in the gold area of the Sierra Nevada in California) sprouted up. Because drilling technology was not well developed and oil was believed to be formed in the earth continuously, about 3,000 barrels a day were wasted when an oil field was found. "The gushers went uncontrolled because early oilmen did not understand geology. Gushers caught fire, oil was allowed to evaporate in earthen dams, or to escape down creeks and gullies in an orgy of waste."[23] In Spindletop, Texas, a gusher flowed uncontrolled for nine days and lost 110,000 barrels of oil each day.

There was a tremendous waste of natural gas during the same period. At that time the oil men didn't know that it was the pressure of the natural gas that brought the oil to the surface, so they allowed the gas to escape into the atmosphere. All through this period, they believed both oil and natural gas were being formed continuously under the earth's surface.

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[22] Steward L. Udall, The Quiet Crisis, p. 71.

[23] Ibid., p. 72.

There were many early disputes over oil and gas rights. Since oil is found in reservoirs under the surface usually one or two wells would be enough to bring it all to the surface, but the courts ruled that the resource belonged to anyone who could capture it. This further led to the exploitation and waste of the resource.

By the 1900s mineral resources were being developed to satisfy the increasing demand by machinery. This in turn led to more machinery and thus more demand for minerals. The spiral grew and continued. "The great increase in the use of minerals as compared with agricultural and forest products is related in part to mechanization. Not only in industry and transportation, but in the home as well, power-driven machines and applications require(d) both metals and fuels in large quantities to maintain our way of life."[24] This exponential growth has continued until the present day.

The standard of living and defense requirements rely heavily on our mineral resources. Our fuel resources are nonrenewable--once they are used they are gone forever. Our metal minerals can be recycled, but at the present time a very small percentage of our metals are recycled. The fuel and nonfuel mineral industries have risen in importance in the United States until now they represent at least one-third of the value of all the raw materials in the United States today; fuel minerals contribute about $15 billion to the gross national product while nonfuel minerals contribute about $7.5 billion.

We face the problem of shortages. The demand for minerals is increasing (both per capita demand and total demand from an increasing population). "It is clear, therefore, that the modern economy must rest upon geologic processes of the past; in almost every case, the geologic processes that form ore bodies are not rapid enough to meet the needs of an industrial society requiring large quantities of materials."[25] Thus, as time goes on, we are importing more and more--now at least one-third--of our minerals.

Ownership of minerals is unique in that an owner may own a piece of land, but not the minerals found there; he may own both surface and minerals or he may own only the mineral rights. This has created conflicts between parties that have land and mineral claims to the same land.

The minerals found on public lands are open to lease to private industry. Today in the United States there are about 11.5 million acres of land being mined by surface and underground methods (this does not include the oil and gas industry). About half of this land is in private ownership, the other half in public ownership (with the land in public ownership being mined by private companies). It has been estimated that one-half of America's gas and oil, 40% of coal, 80% of oil and 40% of uranium lies under federal land. In 1965, the western public lands accounted for 90% of the nation's copper, 95% of mercury and silver, 100% of nickel, molybdenum and potash and 50% of lead.

The oil industry not only owns, but leases, vast amounts of land. Because of the availability of public lands for leasing of mineral rights, outright ownership of land with mineral deposits is not as crucial as ownership of other resources.

The main thrust of the policy on public lands is to provide for the exploration and extraction of mineral deposits. The report to the President and Congress by the Public Land Law Review Commission stated that "While the federal government today retains the right to manage surface values on unpatented mining claims to the extent the locator does not need them in his bona fide mineral efforts, there are presently no adequate regulations defining the relative rights of the federal government and the locator. Furthermore, it is questionable whether such regulations could be adequately enforced, since present law does not require written notice of claim locations to land management agencies."

Basically there are four categories of laws that pertain to the use of minerals: (1) common law, (2) state and local legislative action, (3) federal laws pertaining to public lands, and (4) federal and state laws pertaining to mining operations.

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[24] Guy-Harold Smith, Conservation of Natural Resources. (New York: John Wiley & Sons, 1971.) P. 374.

[25] Ibid., p. 378.

All operations are subject to federal water and air quality regulations, but more specific regulations are rather vague and scattered. Eight states have statutes regulating and controlling strip mining and only nine states have laws specifically regulating private mining practices. Locally, controls are sometimes enforced in the form of zoning ordinances deciding whether mining operations should be permitted and how. This pertains mostly to sand and gravel operations as they are normally located near urban centers.

Even in federal and state water quality laws (which basically is the area in which control could be enforced), strict control is lacking. "Pollution control laws have never shed their point-source bias. Typically, the laws do not give control authorities any right to intervene unless they can trace a pollutant in the river back to the polluter who dumped it in. Many state laws prohibit dumping mine wastes directly into a stream. But there is nothing illegal about just letting them drain away."[26] It is also true that water quality laws only pertain to active mines and don't cover inactive or abandoned mines where the water pollution problem is severe.

Environmental issues concerning mining practices have moved to the forefront in recent years. There have been discussions in many areas concerning banning strip mining completely, both on private and public lands. Before environmental issues relating to mining can be dealt with effectively, it is imperative to understand the very basis of the industry itself. The Department of the Interior, in its report, "Surface Mining and Our Environment," said: "it was, and still is, accepted practice to mine as cheaply as possible the deposits that are most accessible and provide the greatest profit to the producer. This preoccupation with short-term gain too frequently has ignored the long-term social costs involved--the silted streams, the acid-laden waters and the wasteland left by surface mining. Thus, valuable mineral resources have already been lost and several million acres of productive land and waters have been left derelict." The economics of the operation is the guiding force in decisionmaking.

Surface mining methods have a tremendous impact on the environment and thus have come under the heaviest attack. In the same report, the Department of the Interior went on to say that "Surface mining destroys the protective vegetative cover, and the soil and rock overlying the mineral deposit is frequently left in massive piles cast onto adjoining land. The result is a drastic reshaping of the surface, an alteration of normal surface and sub-surface drainage patterns. Square miles of land may be turned over to a depth of 100 feet or more and valleys rimmed by mile after mile of contour benches. Massive landslides have blocked streams and highways, waters have been polluted by acid and sediment, land areas isolated and economic and aesthetic values seriously impaired."

Of the surface mining methods, open pit mining accounts for 35% of the total, while strip mining methods account for 50%, and auger, dredging and hydraulic mining make up the other 15%. In the open pit method when the overburden is piled in waste areas it is a prime source of sedimentation. Since there is little or no vegetative cover to block the rain or hold the soil in place, much of it is washed into nearby streams. Many times the spoil banks also have a large amount of low grade ore in them. These account for leaching of minerals that contaminate both the groundwater supply and streams directly. Waste piles can also be a source of air pollution with the dust and mineral particles being swept up with air currents.

Aesthetic considerations are also important. Over 60% of the surface mines in operation are in full view of public use areas. In the Mesabi Range in Minnesota, there is an iron ore formation approximately 120 miles long and three miles wide. With present open pit methods it not only is an eyesore but may very well turn into a mineral-laden lake or canal.

Strip mining also adversely affects the environment. Coal strip mining accounts for about 41% of the land area disturbed by surface mining. "Spoil stacked at the outer edge of a bench, unless properly drained, causes water to accumulate on the bench between the spoil and the highwall. This accumulated water often becomes polluted and may overflow at the lowest point along the shoulder of the spoil bank during heavy storms, resulting in washout, erosion and stream pollution."[27]

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[26] David Zwick and Marcy Benstock, Water Wasteland, p. 114.

Area strip mining leaves spoil banks of 50 feet high and 50 to 100 feet apart. Here again erosion and leaching are tremendous problems basically because of the waste disposal system.

When coal is mined by surface methods it poses another type of water pollution problem. Sulfur-bearing minerals are normally found associated with coal. When they are exposed to air and water they form sulfuric acid which, in high concentrations, is toxic to all aquatic life. At the present time, 5,800 miles of streams and 29,000 surface acres of lakes are affected by coal mining operations. On coal mined in Appalachia by surface methods it has been found that sediment yield is at least 100 times greater than it is normally.

Iron also causes heavy acid leaching and can be fatal to fish and other aquatic life. Certain bacteria are able to obtain energy by changing iron from one oxidation state to another (ferrous to ferric). With an unlimited amount of iron they multiply greatly, their by-product being an orange-red precipitate, the acidity of which is caused by sulfuric acid.

Dredging in streams and shallow lakes results in the complete upheaval of the bed and in tremendously large quantities of sediments. The effects of sedimentation has been discussed earlier, but with the removal of sand and gravel in dredging, there are further environmental considerations. The destruction of spawning sites for fish and the widening of stream channels which changes stream velocity and water temperature are two major effects.

Hydraulic mining also increases sediment load of rivers by washing tons of soil from the hillsides directly into stream beds. Because of the use of hydraulic mining in the Sierra Nevadas in California for gold, shoals have been created off the Golden Gate at San Francisco due to the tremendous increase in sediments carried by the rivers to the Bay and out the Gate.

The basic effects of surface mining are:

1. Air pollution in the form of dust from waste piles.

2. Land pollution; only 50% of the land used for strip mining is returned to its original cover; 25% of the spoil material was fit for agricultural use. Because reclamation of surface mined areas is not required in most states, large areas still lay barren, even after deposits have been long exhausted. It has been reported that about one-third of the abandoned surface mines have turned into makeshift junkyards.

3. Water pollution in the form of sedimentation and acid drainage.

4. Aesthetic: surface mined areas are abominations to behold.

Underground mining operations are also a source of environmental problems. Acid drainage is not unique to surface mining; this problem plagues underground mines also. The major problem of acid drainage in underground mines comes from areas that have been abandoned and not plugged. Abandoned underground mines today account for 60% to 80% of total acid drainage. Current operations are also a source: "A study by the U. S. Bureau of Mines completed in 1969 showed that in two-thirds of all active mines, water that has drained into the mine is pumped back up to the surface and discharged directly into an adjacent stream. At the time of the Bureau's investigation only 16% of this discharge water was being given treatment."[28]

There are, however, available techniques that could conceivably decrease mine drainage by up to 70%: improved mine design, plugging holes in mine surfaces, diverting underground and surface water courses around instead of through mines, pumping water out and neutralizing it with chemicals before disposal and plugging inactive mines. These techniques could be used but are not, basically because they are not economic.

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[27] Ibid., p. 111.

[28] Ibid., p. 111.

Processing, which many times takes place at the mine site, generates large amounts of waste materials, uses tremendous amounts of water and chemical agents and produces about 3.5 million tons of sulfur dioxide each year (accounting for .2% of total atmospheric sulfur pollution).

Subsistence is an effect of underground mining that is far reaching. After the large amounts of minerals are extracted from beneath the surface, the earth has a tendency to re-distribute itself and fill the cavities left by mining. Two million of the eight million acres in underground mining have been affected by subsistence (ninety-five percent of this two million acres is in coal production). This change in the very structure of the land has adversely affected land values, damaged crops and altered drainage patterns. In urban areas it has caused buildings to cave in, pipelines to break and pavement to collapse.

Solid waste is a particular enigma. There have been a total of 18.5 billion tons of material removed from underground mines that have been spread over 1.8 million acres of surface area. The copper industry has been the biggest culprit as a source of solid waste.

Air pollution from tailing piles can be dangerous, especially where radioactive uranium is being mined. Air currents pick up dust and small mineral particles and spread them for miles, falling on both urban and rural areas. Smoke from underground mine fires is also a contributor to the air pollution problem.

Oil and natural gas production, though they take the least land space of all methods of extraction, are not without effects on the environment. "In the process of oil drilling on land, between 10% and 90% of production will be brine. The salt content of this fluid is so highly concentrated that it cannot be put into the sewer or storm drain system or dumped into the ocean. It cannot be economically treated for disposal because of its toxicity to the treatment process and inorganic composition. Therefore the city (Los Angeles) requires that it be put back into the ground."[29]

The brine is pumped back into the ground and contaminates ground water supplies and finds its way into streams and other bodies of water.

Subsistence occurs with the extraction of large amounts of fluid and natural gas in the oil drilling process. Other environmental effects of oil and gas extraction are: (1) spills from drilling, (2) seepage from oil bearing materials near the surface when the area is disturbed, (3) air pollution from fires that occur during drilling operations, (4) aesthetics concerning the number of wells placed on the landscape (because of the reservoir structure one or two wells is usually sufficient to drain a reservoir).

The transportation of oil and gas has recently been in the public view because of oil spills in ocean waters and also because of the proposed Alaska pipeline. The proposed pipeline would disrupt permafrost conditions and impede migrations of certain wildlife species and thus has come under fire from many conservation groups. Its future is unclear at the present time.

Mining and mineral extraction, by nature, is a disruptive process. As long as economic considerations are the only guiding force, environmental problems associated with this use of land will multiply.

Outdoor Recreation

In the last 50 years outdoor recreation has become an important part of the American life-style. As the pace of living increases and the pressures of society mount, the American is finding greater and greater need for outdoor recreation. "The term recreation implies that the participant is recreated in some aspect--physically, psychologically, spiritually, or mentally; that he becomes revitalized and more ready to cope with his trials. In order to qualify as recreation, an activity must do something desirable to the participant. It must enrich him and add joy and satisfaction to an otherwise routine day."[30]

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[29] "An Environmental Conservation Element for the Los Angeles City General Plan," City of Los Angeles Planning Department, 1970, p. 98.

Outdoor recreation is a different type of land use than has been previously discussed here. There are many different types of recreation activities--from skiing to hiking, from sightseeing to pleasure driving. Because of its very nature outdoor recreation can and does have far reaching environmental effects.

The effect on the environment of outdoor recreation as a land use depends greatly on the intensity of use. There are a number of major factors that affect the level of outdoor recreation in the United States today:

Work Leisure--"While the prescription to work remains strong, changing values and conditions increasingly challenge the work ethic. For needs unfulfilled by the job, Americans look to their non-work lives. Outdoor recreation represents one of the most popular uses of leisure time yet as millions of people seek enjoyment from the outdoors, they affect their natural surroundings. Leisure, just as work, can thus have environmental consequences."[31]

In 1850 the work week was 70 hours; in 1940 it had decreased to 40 hours; soon, it is likely it will decrease again to a 36-hour week. This leaves a great deal of time in which an individual can engage in outdoor recreation activities.

Paid holidays and longer paid vacations are having a profound effect on outdoor recreation. Longer paid vacations are allowing people to go farther and stay longer.

Population Characteristics--The effect of increases in population on the physical environment is obvious. The more people there are in a given area pursuing a certain activity, the greater the effect on the environment. The population of the United States has increased greatly since the turn of the century. Our population is growing at the rate of about 2 or 3 million people per year. The United States Commission on Population predicts that by 1975 there will be 235 million people living in this country. This increase, considered by itself, would increase outdoor recreational activities and correspondingly have a greater degrading effect on the environment.

Age breakdown also has an effect in that younger people and older, retired people engage in outdoor recreation the most. In 1940, 25% of the population was 15 and under; by 1969 it was 34%. In 1940, 10% of the population was 60 or older; by 1969 the percentage had risen to 15%. This change in age distribution coupled with the increase in population has the effect of greatly increasing the demand for outdoor recreation.

Disposable Income--As income rises, an individual will be able to spend a larger percentage on luxury items, or on items that are not directly needed for his daily physical sustenance. Per capita (and disposable) income has risen in the last forty years. In 1930, per capita income was $1224; by 1970 it had increased to $2800. With higher income the population can afford to travel farther to reach recreation areas that were before inaccessible to them for economic reasons. They also can afford to purchase and spend more in pursuit of recreational activities. In 1967, Americans spent $9.6 billion on recreation equipment. In 1970, they spent close to $18 billion.

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[30] Clayne R. Jensen, Outdoor Recreation in America. (Minneapolis: Burgess Publishing Company, 1970.) P. 9.

[31] Lewis B. Kimmelman, "Introduction." In Outdoor Recreation and the Environment, Report for Summer Fellows Program, Environmental Protection Agency, 1972, p. 4.

Availability--Non-urban recreation areas are more available today because of the increased mobility of the American people. More people own cars (1 car for every 2.8 people), there are more highways and freeways (up 30% since 1960) and more money is being spent on travel (today $25 billion spent on travel). Thus, it is easier and faster to get from one place to another today. For example, to get from San Francisco to Lake Tahoe (a high-use non-urban recreation area for northern California) used to take about 5 1/2 hours in the late 1950s. Today it takes about 3 1/2 hours. Weekend trips of hundreds of miles are now a reality and naturally the pressure on the far away non-urban recreation areas increased.

Urbanization--There has been a mass migration to the city in recent years. In 1950, 64% of the population lived in urban areas; by 1980 about 80% of our people will live in the cities. "In spite of many advantages enjoyed by city dwellers, there is much criticism of the large cities as places to live and work. They are attacked for their inherent ugliness, lack of order and unity, congestion, conditions of poor sanitation and lack of open space."[32] This pressure leads to more weekend recreation activity and, for those who can afford it, two homes--one in the city and one in the country.

Education--There is also a relationship between education and outdoor recreation, which is basically two-fold: (1) the higher the education, the larger the income and, thus, more money for recreation activities; (2) the higher the education, the more a person is apt to appreciate the spiritual and philosophical value of "getting back to nature."

Automation and Technology--"Needless to say, the new mode influences what we do for outdoor recreation, where we go for it, and how much time we spend doing it. In some cases, automation and technology have almost made outdoor living more convenient than staying at home and have opened new avenues in recreation pursuits. For example, some of the popular outdoor recreation activities now enhanced are speed boating, water skiing, camping, hunting and fishing and snow skiing. Without the modern devices our outdoor recreation patterns would be quite different from what they are now."[33] The "new conveniences" that we are using also have an effect on the environment: off-road vehicles, new mobile homes, etc., have a tendency to intensify the effect the individual has on the environment while he is pursuing his outdoor recreation interests.

These factors together have led to an explosion of outdoor recreation activity since World War II. A study in 1966 gave the breakdown of activity and man hours as follows:

Activity	*Million Man Hours*
Travel for pleasure	5,330
Visits to public outdoor recreation areas	10,895
Fishing in all areas	1,500
Hunting in all areas	1,125
Boating of all kinds	600

Each of these factors (population, income, availability, urbanization, education, automation and technology), taken alone, would increase demand for outdoor recreation; taken together they have almost a multiplying effect. The demand for outdoor recreation has increased greatly since World War II. On public lands, the demand for recreation, measured in total number of visits, looks like the following table.

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[32] Clayne R. Jensen, Outdoor Recreation in America, p. 39.

[33] Ibid., p. 52.

Agency	*Total Visits (in millions)*	
	1960	Projection for 2000
National Parks	90	50,000
State Parks	300	52,000
Corps of Engineer Reservoirs	120	800,000
National Forests	90	800
TVA	55	7,400

The private sector provides such recreation as resorts, dude ranches, campgrounds, ski areas, vacation farms, boat and yacht clubs. A Bureau of Outdoor Recreation study has shown that last year private recreation facilities had a total of 1,181,125,896 patrons. Of these people, 70,751,023 stayed overnight at the facilities. In both the public and private sector we are facing a staggering increase in the demand for outdoor recreation.

In non-urban areas, outdoor recreation areas have been classified by Marion Clawson:[34]

Item	*Type of Recreation Area*	
	Intermediate	Resource-Based
General location	Must not be too remote from users; on best resources available within distance limitation	Where outstanding resources can be found; may be distant from most users
Major type of activities	Camping, picnicking, hiking, swimming, hunting, fishing	Major sightseeing; scientific and historical interest; hiking and mountain climbing; camping, fishing and hunting
When major use occurs	Day outings and weekends	Vacations
Typical size	A hundred to several thousand acres	Usually some thousands of acres, perhaps many thousands
Common types of agency responsibility	State parks; private	National parks and national forests primarily; state parks in some cases; private, especially for seashore or major lakes

With increasing demand as it now stands, supply of intermediate and resource-based areas is critical. "The rapid growth in outdoor participation has occurred upon a supply of land and facilities which have not kept pace with demand . . . while the supply is expandable, there are ultimate limits to the amount of seashore, parks, and resort developments that can be established. Recreation will be competing with a host of other land uses for increasingly scarce open space. Thus, existing lands and facilities must be preserved as a reusable resource, one that satisfies each user's needs over years and even generations."[35] A close look at the total acreage in the public and private sector will give a premonition of the effect that skyrocketing demand will have on the environment. The public recreation land breakdown is:

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[34] Marion Clawson, America's Land and Its Uses, p. 72.

Federal Agency	*Millions of Acres*
Bureau of Land Management	117.8
Forest Service	164.9
National Park Service	15.2
Fish and Wildlife	0.2
Other Agencies	40.4
Total	406.5

The total supply of state parks, state forests and county parks is about 25 million acres, bringing total public recreation land area to about 432 million acres.

Two things must be pointed out here. First, nearly 96% of the land the Federal government owns is located in the 17 western states, while our largest population centers are located in the eastern part of the United States. While the state park system will relieve some of this pressure, it represents only about 5.5% of the total acreage of public land. Secondly, even with the vast acreage of public land it must be remembered that recreation activity is very localized by the level of recreation development. For instance of the 164.9 million acres of national forests available for recreational use, the Forest Service has identified only 14 million acres for recreation; and only 70,000 acres are in improved sites. When projections of demand for the year 2000 (800,000 million visitors) are examined against supply, the impact on the environment could indeed be awesome. The national parks are in the same situation: a projected demand for the year 2000 of 50,000 million people and a total acreage of 15.2 million acres (with most of the use concentrated on a much smaller area than that).

The Bureau of Outdoor Recreation study found that there are about 30,025,200 acres in private recreation land, and it is safe to assume that the demand will be increasing (although perhaps not as fast as for public land because of the price structure). "Problems of maintenance of the outdoor recreation experience are not limited to public areas. The operator of a private campground is under considerable temptation to squeeze in a few more campsites and to admit a few more campers, for often his profits seem to lie in a little larger volume of business; his costs do not rise as fast as his income, when intensity of use rises. Or he may be tempted to erect advertising signs to draw in larger numbers of visitors, even though these signs disfigure his landscape. In each case, he may achieve a short-run monetary gain at the expense of a long-run loss in quality. Pressure to meet his competition may also lead him to manage his recreation resource in ways that he would otherwise not choose."[36]

The partial answer may seem to lie in the expansion of the intermediate areas that are closer to the population centers. Another opportunity might be the opening up of private forest and ranch land to the public.

There are certain types of controls over recreation land use. In the private sector there are zoning laws establishing where and what kinds of land use activities can take place. Once a facility is established it is subject to federal, state and local air and water quality laws. Basically, however, the private recreation industry is one that, so far, has not been the focus of attention for legal land use controls directly aimed at this kind of land use.

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[35] Lewis B. Kimmelman, Outdoor Recreation and the Environment, p. 11.

[36] Marion Clawson, America's Land and Its Uses, p. 85.

The public sector has a different framework. Recreation is one of the multiple uses established in The Multiple Use and Sustained Yield Act of 1960. When the recreation boom started to be felt by public agencies the answer was to meet demand with an increasing supply--new campgrounds, new wilderness areas, new roads, etc., hoping to keep up with the demand. Agencies have had some control over the area where recreation activities would take place by their placing of improvements and facilities. However, in recent years they have come to realize that it will be impossible to build enough facilities to meet the increasing demands, so they have been forced to consider controlling the number of people who use existing facilities. Federal agencies are now using pricing in some areas, i. e., national parks, national forest campgrounds, etc. There have been arguments with this method because of its effect on low income families. Other controls that are being considered and tried on a limited basis are rationing (certain number of visits per year), reservations, first-come-first-served, permits, closing areas, etc. The ultimate effect these types of controls will have on the demand and use of facilities and the public reaction to them is uncertain.

As the use of outdoor recreational facilities has increased there has been a corresponding decrease in the quality of the environment. "The problem of deterioration of both the environment and the recreation experience due to overcrowding has reached crisis proportions in many recreational parks and is likely to occur more frequently in wilderness areas in the future. Annual visits to Yosemite National Park have risen from 640,000 in 1946 to 2.3 million in 1969. On Memorial Day weekend in 1969, over 70,000 visitors and their vehicles entered the 7 square miles of the Yosemite Valley floor. This kind of pressure destroys natural environment and reduces the quality of a park visit for most people caught in the traffic jam. Similarly, the impact of concentrated uses, carelessness, and littering are destroying the undisturbed character and the fragile ecosystems of some portions of visits in the wilderness system."[37]

The major factor in the degradation of the environment is the intensity of use in a limited area. Most outdoor recreation use is concentrated around water sources and constructed facilities (campgrounds, trails, etc.) resulting in a heavy impact on a small part of the total environment set apart for recreation purposes.

Air pollution as a problem in recreation areas is on the rise, especially in areas that are located in pockets. Yosemite Valley is facing this problem from the automobiles in the park and also from the smoke from thousands of campfires. As recreation demand increases, more roads are built, allowing for more automobiles which serves to increase the problem.

Water pollution is another problem that is related to outdoor recreation. Since many recreation activities are water oriented, contamination of water supplies is an ever increasing issue. In areas that do not have toilet facilities, the sewage created by the human population is affecting water and ground water supplies. There are many environmental consequences of water sports, including oil and gas leakage from motorized boats, sewage, and litter.

Noise pollution also is a question that plagues many recreationists. With the number of motorized vehicles, and the use of electric generators, portable radio and stereo sets, etc., there seem to be very few places to turn for peace and quiet, a valuable part of the recreation experience for many people.

Perhaps the biggest issue, however, is the effect of recreation on the land. Campgrounds are faced with the removal of tremendous amounts of vegetation simply from regular use by the recreationist. "Too many people can have serious physical impacts on an area--the human foot can be as destructive as the bulldozer, if there are too many feet. . . . There is grave danger that preoccupation with rising number of visitors will obscure what is happening to the quality of the area and of the recreation experience."[38] Since so many campgrounds are located on streams and lakes the sedimentation and erosion problems created by the loss of vegetation are increasing at an alarming rate.

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[37] One Third of a Nation's Land, a report to the President and the Congress by the U. S. Public Land Law Review Commission, 1970, p. 207.

Many areas that are used for recreation have very fragile ecosystems. Wilderness areas fall in this category. The Outdoor Recreation Resources Review Commission in its report of 1962 said that "recreation misuse and overuse are most evident along major trail systems and camping sites, and comprise a significant problem at favorite campsites in nearly every wilderness area. The soil and vegetation in many wilderness reservations are considerably more fragile and sensitive to human use than lands having deep soils and long growing seasons. Adequate meadow acreage for saddle and pack stock grazing, or sufficient quantities of dead trees and litter are not always available to sustain continuous camping use of a wilderness site in a single season. . . . One important value of a wilderness tract derives from its having never been seriously violated. Almost by definition, therefore, wilderness cannot be restored to the point where it provides all values. . . . The time required for restoration is considerable; the process cannot be forced. And it varies with location of a tract, its indigenous flora and fauna, its micro- and macro-climatic conditions, its accessibility and the condition from which restoration begins." It is evident, especially in areas with fragile ecosystems, we are changing the face of the earth with our recreation patterns.

With the introduction of the off-road vehicle to recreation areas there have been cries of protest. Not only are they sources of air, noise and land pollution, they are also having a detrimental effect on the psychological experience of other users. There is nothing as depressing to the backpacker than to see, hear and smell the mini-bikes and tote goats as they speed up the trail. However, there are moves now to limit the use of such vehicles to specific areas.

Degrading environmental effects are not limited only to public areas. Private recreational enterprise, because of their economic view of recreation, also have contributed. Ski areas have long been sources of erosion and sedimentation. Aesthetic values have also been affected by the large barren areas that are seen when snow is not on the ground. For years Heavenly Valley (a ski area on the southern shore of Lake Tahoe, Nevada) has been one of the biggest sources of sedimentation and erosion in the Lake Tahoe region.

Coastal Areas. Coastal areas, since the very beginning of our country, have been places where people have congregated. In 1940, coastal states had roughly 81% of the total population. In 1970, about 85% of our population lived in coastal states. With the increasing number of people moving to coastal states, coastline recreation has increased tremendously. National seashores have felt this increasing pressure, as they are prime places for shoreline recreation.

In the 20 year period from 1934 to 1954, the Department of Interior found that use had increased from 5,000,000 to 61,000,000 on New York public beaches. As in other forms of recreation, demand is increasing rapidly, but shoreline areas are really feeling the "crunch" because of their very close proximity to large metropolitan areas.

Ownership patterns (and their accessibility to the public) play a major role on the impact of this use. Federal, state and local governments own only about 14% of the shoreline in the United States (excluding Alaska). Public recreational use, therefore, is concentrated on a very small area of land.

Coastline areas suffer a high level of erosion. In a national assessment of coastline erosion, the Corps of Engineers found that of the 84,240 miles of shoreline (excluding Alaska), 20,500 miles showed significant erosion, 2,700 miles showed critical erosion, 17,800 miles showed non-critical erosion while 63,740 miles were non-eroding.

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[38] Marion Clawson, America's Land and Its Uses, p. 83.

The introduction of dune buggies has acted to alter the dune system, destroying vegetation and changing the dune structure. Other recreational activities also have a degrading effect.

As time goes on there is an increase in conflicting uses of coastline areas. Industry, oil and power companies are finding the coastline more attractive for the siting of their facilities. Second home developments are also rapidly increasing in coastline areas. The increase in commercial, municipal and private usage has two effects on recreation and the environment. First, access to the seashore has been greatly reduced by the large amounts of land in private holdings. Second, these uses are sources of environmental problems themselves. Municipal areas are dumping their sewage into offshore areas creating water pollution problems. "Adding to this problem of human waste, chemical pollution from industry as well as thermal pollution from power plants, it becomes evident that something must be done. Thermal pollution, because it is still at a low level of damage and because much research is being done on it, may not be too hard to control. However, nutrient pollution from domestic wastes and public chemical pollution have the potential to damage much of the Bay and its tributaries."[39] These factors result in less coastline suitable for recreation purposes and thus, areas that are suitable and pollution-free will face large demand from recreationists and, in turn, suffer heavy environmental consequences.

There are very few controls on the use of land or on our nation's coast. However, in November of 1972 California passed a Coastline Conservation Referendum establishing a number of coastline conservation and development commissions. Land from high tide mark to 1000 feet inland will be subject to their planning and control.

Second Home Developments. Second home recreational developments have been an increasing phenomenon in the last ten years. The same factors that have led to the increase of outdoor recreation have also led to the increase in second home recreational developments (indeed, owning and vacationing at a second home should be considered a type of recreation itself).

The development process that land development companies themselves use gives a good insight into the attitude toward the land and the environment. The first thing a company does is to find a large section of land that is not zoned or not zoned for high density use. They then buy up all the land in that area, usually for a small percentage of what will be their sales price to prospective customers. "Once the options are all in for the purchase of the land, the developer then moves into more serious planning and preparations, investing in necessary preliminary engineering, drawing of maps, borrowing of money, and preparing the local community. First, there are discreet enquiries as to whether the local business community wants such a development, usually coupled with glowing goldmine estimates of the trade that will accrue to them. Then comes the assault on the local planning commission or board of supervisors."[40]

Even at this point the local planning commissions rarely have the expertise, staff or money to make a complete study of the proposed development. Meanwhile, the developer brings in his battery of experts assuring the planning commission that the proposal is a good one economically and environmentally. In order to get the development approved, the land has to be re-zoned for density development, the job of the local planning authorities.

One of the main arguments used by developers is, of course, economic. They say that with the expanded tax revenue base the community will be much better off economically. But, if the development is not successful, the local community is stuck paying for the new roads, new sewers and new water lines. In one northern California county "there is a 28% delinquency rate in tax payments coupled with a $2 million bill from repairs on roads, drainage, sewage, etc., installed by the promoters to be paid by county tax payers."[41]

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[39] Keith Bildstein, "Coastline Recreation." In Outdoor Recreation and the Environment, Report for Summer Fellows Program, Environmental Protection Agency, 1972, p. 20.

[40] Power and Land in California: The Ralph Nader Task Force Report on Land Use in the State of California. (Washington, D.C.: Center for the Study of Responsive Law, 1971.) p. IV-22.

Local planning boards are very susceptible to pressure from the local business community (indeed they are usually part of the business community themselves), and the promise of economic gain by the developers brings much pressure to bear by the business community itself.

The construction of the development itself has high environmental consequences. "Erosion and siltation of streams is a serious problem. In Nevada County (California), an estimated 160 miles of streams (37% of the stream mileage in the county) has already been damaged by siltation, stream bank alterations and domestic waste discharge. . . . In addition, five major reservoirs within the county have been degraded by turbid waters from development run-off. At Lake Tahoe, erosion from subdivision roads is the biggest source of sediment draining into the lake (48%). Such roads produce average annual sediment discharge into the streams ranging from 40 to 165 cubic yards of material per mile. One result is the reduction of stream flow to water supply needs. Poor design of mountain roads is responsible for much of the erosion. Approximately one out of six acres per square mile of the typical mountain subdivision will be occupied by roads and structures once it is fully developed. This results in double or triple the normal peak run-off following a heavy rainstorm which in turn results in great amounts of bank erosion, channel scouring and consequent damage to fish habitat. . . . Erosion may increase from as little as 50 tons to as much as 50,000 tons per square mile."[42]

The developers are following all the rules when they propose and develop land. The water quality laws concerning construction and sedimentation and erosion are at best vague. So the development process continues unaltered as the environment suffers the consequences.

A Concluding Comment on Non-Urban Land Use

Basically non-urban areas are the locations from which we extract raw materials for our economic development and where we spend much of our leisure time. Regardless of the type of use we are considering, the natural environment will be disrupted; it is inevitable. The questions to be considered are, "How much disruption is inevitable?" and "What part should environmental quality play in this decision?"

This discussion has considered the various ramifications of our non-urban uses of land on the environment. Basically the conclusions are:

(1) Private ownership of land in non-urban areas is in larger and larger holdings, with conglomerate-type companies being the major owners. Especially in non-urban areas, the ethic of "It's my land, I'll do what I want with it," still is prevalent.

(2) Both public and private management is primarily decided upon by an economic cost/benefit analysis. Environmental considerations come into play when it results in an increased cost to the owner.

(3) Land use controls are aimed not at controlling the type of use, but rather the effects of that use. These controls, as formulated now, have not been effective in dealing with and solving environmental problems created by the various land uses.

(4) The quality of the environment is closely tied to land use patterns and is rapidly deteriorating.

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[41] Ibid., p. IV-24.

[42] Ibid., p. IV-12.

The increasing concern for our environment has been aimed mostly at our urban and suburban areas, simply because those are the places where people spend most of their time. It is past time we took a hard look at the land use patterns and practices and their environmental effects on our non-urban areas, for these are the places we must save if we are to ourselves survive.

Urban Land Use

In an analysis of present urban land use, one must examine the past because of the relationship of today's urbanization pattern and yesterday's urban land uses and processes. For this reason, urban land use will be examined in the five eras that brought about the greatest changes in the use of urban land, and which had the greatest impact on urban land use patterns today. These eras are: (1) the early colonial period, (2) 1830-1870, (3) 1900-1935, (4) 1950s and 1960s, and (5) the 1970s and the future.

Early Colonial Development--Cities have always played a major role in the social and economic structure of any civilization. "The clustering of populations into communities is one of the basic forms of human settlement. It arises from man's need for cooperation in order to survive, from his gregarious instinct, from certain external economies that may be obtained when his activities are centralized, and from the fact that distance is a physical obstacle that can be overcome most rationally by centralizing certain functions within geographic space."[43]

In early settlements the colonists tended to stay close together for safety. As more settlers arrived, they began to move away from the early settlements and develop farms. Nevertheless, they still depended on the early cities for supplies and other economic benefits. "America's oldest cities were mercantile outposts of a resource area which was exploited by the developed metropolitan system of Western Europe. The initial impulses for independent urban growth came at the end of the eighteenth century, when towns were becoming both the outlets for capital accumulated in commercial agriculture and the centers of colonial development of the continental interior."[44]

During the colonial period, location was the most important factor in city growth. Those cities that located on major navigable waterways and on natural bays on the East Coast played the major role in the growth and economic development of the colonial United States.

The European idea of town planning played an important role in the physical structure of early American cities. In Europe, land was at a premium and planning for existing space was intricate. The American colonists started using the European methods of laying out towns (rectangular and gridiron methods), with one fundamental difference. "The chief and most obvious characteristic of American cities is that they were planted in a wilderness--set down, so to speak, in a newly discovered, 'history-less' country. European models were followed at first but, with very few exceptions, these models had soon to be modified by the American environment."[45]

There were early examples of planned cities, Washington, D.C., and Philadelphia, Pennsylvania, being two of the most prominent, but even in these early towns, speculation was evident. "Efforts in America to establish planned communities, whether large or small, conflicted with the pressures created by an expansive, capitalistic economy. In the struggle between the speculator and the architect, the planner or the visionary, the speculator ordinarily won. The founding of the Nation's capital supplies a case in point. During the years in which Washington was being built, real-estate holders in the District of Columbia were involved in decisions and continually tried to alter the plan for the city made by the French engineer, Pierre Charles L'Enfant."[46] Indeed, the speculators had a profound effect as they were responsible for the Washington, D.C., plan being taken away from L'Enfant because he would not succumb to their speculative interests.

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[43] Regional Development and Planning: A Reader, edited by John Friedman and William Alonso. (Cambridge, Mass.: The MIT Press, 1964.) P. 345.

[44] The Quality of the Urban Environment, edited by Harvey S. Perloff. (Baltimore, The Johns Hopkins Press, 1969.) p. 258-259.

[45] The American City: A Documentary History, edited by Charles N. Glaab. (Homewood, Illinois: The Dorsey Press, 1963.) P. 34.

William Penn wanted Philadelphia to be, in his words, "a green country town, which will never be burnt, and always be wholesome," and it was for a time with its tree-lined avenues and paved streets. But because the individual could do as he pleased with his land, the eventual growth patterns and subsequent problems in Philadelphia would make Penn's dream just that: a dream.

The gridiron method of planning was one of the early methods used for the structuring of horizontal space in early cities. In his book, The City in History, Lewis Mumford characterized the gridiron system in this way: "On strictly commercial principles, the gridiron plan answered, as no other plan did, the shifting values, the accelerated expansion, the multiplying population, required by the capitalist regime. But the city planned on those principles was a failure for other human purposes; and any attempt to improve it without changing those principles was doomed to defeat. Planning, by nature, is a comprehensive process, involving the interplay of many needs, purposes and functions: whereas planning as was done by the individual enterpriser was a piecemeal effort for his own limited gain."

These early planning attempts accommodated rapid growth and speculation and, therefore, the building and expansion of our earliest cities was influenced primarily by economic factors, both in terms of where they were located and how they grew. This land use ethic not only was firmly entrenched in the American cities, it was the very basis of the American cities.

1830-1870: The Rise of Industrialization and Rapid Expansion--By the middle of the 1800s, the United States began to grow and expand very rapidly. "To a large extent, this expansion rested on commerce, both foreign and domestic. The growth of both seaboard cities and those located on the interior lakes and rivers was sustained by the opening of the interior hinterlands and the expansion of trade brought about by improvements in transportation, the introduction of the steamboat, the building of canals, and in the 1840s, the large-scale development of railroads."[47]

Industrialization. Industrialization, which had its beginnings in the early 1800s, now moved into full swing. Before the expansion of the railroad system, cities could not efficiently transport goods over great distances, so they were limited in the amount they could produce by the demand for goods and services in their region. (They also, of course, had physical production limitations.) When the new modes of transportation allowed cities to move their goods to other regions (thereby increasing demand for their products), they could begin to grow independently of their regional demand criteria. Thus, with the expansion of the railroads came rapid industrialization, creating more jobs in the cities than ever before. This began the first real migration to the cities. Interior cities began to grow rapidly. In 1830, Chicago was a small village of 30 inhabitants. By 1860, it had grown to a city of 100,000.

As more and more people moved to the cities to fill the available jobs, the city structure, naturally, began to change also. There began an outward expansion as both residential and industrial development flourished. How far they could expand was limited by the mode of transportation of the city areas, the horse and buggy.

In 1800, 6% of the population of the United States lived in cities of more than 2,500 people; by 1860, this figure had increased to 20% and continued to rise. As city population increased, so did the continued expansion of cities on a horizontal plane. The rapid growth was a process occurring without control, as speculators bought and developed land for the new city dwellers and businesses.

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[46] Ibid., p. 34.

[47] Ibid., p. 66.

Early Environmental Problems. With the rapid rise in industrialization came the birth of serious city related environmental pollution. Factories spewed smoke, soot, and other particulate matter into the air and dumped raw wastes into the streams. As the cities grew, so did water pollution problems related to human sewage. Environmental consequences of these actions were not even considered, as densities were still low and the environment was able to assimilate the wastes the cities produced. The "right to pollute" became just as accepted as the "right to own and develop land."

Industrialization and growth of cities continued through the late 1800s and into the 1900s. This growth was accompanied by an expansion of the city perimeter away from the central core. Land was still plentiful and the land ethic remained unchanged.

1900-1935: The Rise of Technology--The events that took place during the period of 1900-1935 eventually would have profound effects on the future of the structure of the urban and surrounding fringe areas. By 1900, about 40% of the population of the United States lived in city areas. By this time, "a significant number of changes in the technology of transportation and communication began to appear. The telephone had been demonstrated to be practicable and the new companies were rapidly enlisting subscribers. Costs of transmitting electric power were being reduced to the point where it was becoming a feasible household utility. Intracity pipelines for water, sewage and gas were being extended from the inner to all sections of urban centers. . . . The motor vehicle made its appearance on city streets."[48]

These innovations allowed the city to spread out still further from the city center. At first, the introduction of the automobile did not have a tremendous impact on the spatial arrangement of activities, simply because the road system was not yet highly developed. However, it did begin to give the individual more control over his mobility, as well as to allow him to travel greater distances in shorter periods of time. As the road system did develop, the automobile began to have an increasing effect on the spatial patterns of the day, allowing individuals to live farther away from the city and their jobs.

Before the full impact of the automobile was felt, the effects of the interurban train system (developed in the early 1900s) would be tremendously important. Instead of serving the existing developments outside the immediate confines of the city (and other cities located nearby), it acted as a catalyst for new developments along its lines. For the first time, people could live miles from the city and still work there. Speculation increased markedly as early suburbanization followed the rail lines away from the city.

At this time, construction and structural technology did not allow the city to grow very much in a vertical direction. As a result of the new methods of transportation and the continuation of migration to the cities, outward city growth continued.

Immigration. Social and health problems began to increase in the city with the increase in immigration. When European immigrants arrived in America they found low-paying jobs in the cities, and for this reason, their standard of living was low and they were forced to live in tenements and slums. As the slums grew, the white middle class was reacting by moving out to the urban fringe areas.

The Increase in Environmental Problems. Environmental problems began to worsen in this era. Instances of heavy air pollution from city factories became more and more evident. If an inversion layer happened to form over the city, the smoke and particulate matter released by the factories remained near the ground, causing sickness and sometimes death. However, these instances occurred seldom so that city dwellers and governments did not react severely.

Water pollution increased also, as more industries were developed in urban areas. The human waste problem began to increase at this time, especially with the increase of high-density slum districts. But to most of the city inhabitants it was an "invisible problem" and therefore not to be taken seriously.

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[48] Amos H. Hawley, Urban Society: An Ecological Approach. (New York: The Ronald Press, 1971.) P. 146.

Introduction of Land Use Controls. As people moved to new areas in and around the city, they became concerned with the kinds of activities that would be located near their residences. This led, in 1916, to the adoption of the first zoning laws. These laws, however, were developed for reasons other than alleviating major environmental problems: "The objectives of zoning were: (1) the protection of property values by requiring uniformity in each district; (2) exclusion of dangerous and nuisance uses from residential districts; (3) prevention of the over-exploitation of land and the reduction of building density; (4) fostering public service efficiency."[49]

Instead of dealing with the major cause of environmental pollution (basically the industries), city dwellers were content to "deal with" the problem by moving away from the source. New zoning laws would keep the industries in certain areas of the cities where the inhabitants didn't live. This, of course, postponed dealing with the issue of emission-source pollution.

In the mid-1930s, subdivision regulations were introduced that conceivably could have controlled the location and the rapidity of new development; however, they were used more for guiding growth, as growth, for its own sake, was considered proper and desirable. America became firmly entrenched in this "Watch America Grow" syndrome and subdivision ran rampant: "In Florida, enough land was subdivided to house the population of the entire United States. In northern Westchester County in New York State and along the New Jersey coast, thousands of twenty-foot lots were distributed by newspapers as free gifts to subscribers."[50]

America's land use controls were based solely on economic criteria and fostered the ethic that land was a commodity, and a cheap one at that. The land use controls led the rapid pace of growth that characterized this era.

The 1950s and 1960s: The Era of Technology--The post-World War II period to the 1960s had the greatest impact on today's city environment. Urban population had increased to 60% of the total of the United States. The advent of new, faster transportation systems, the rapid rise in building technology, the increase of inner-city social and racial problems, the rise of urban environmental problems and the migration to the suburbs played an important part in the change that would occur in the structure and growth of America's cities.

Technology. During this period, there began a tremendous growth in highway building technology. A massive program of highway and freeway building was started that would revolutionize the speed and ease of transportation by car.

As the highway system grew and moved away from the city, land developers and private individuals found that it would be profitable to develop land at major interchanges and key locations along the highway system. For the first time, large developments evolved that were, in a sense, independent of the city. These developments would depend on the new road system that would bring the people to them.

At the same time these innovations were occurring outside the city, changes were taking place in the inner-city structures. High-rise technology became a reality as new materials and new engineering techniques were developed. Land owners highly favored the development of the high-rise complex. The zoning and building codes were of little use in controlling compatible development.

As air and water pollution problems increased in the city, emphasis was placed on pollution abatement technology as an answer. Americans, as they looked back, were in awe of technology and its accomplishments, and thus, there was a firm belief that it would also solve the pollution problem that was becoming very serious. This belief in technology, as an ultimate solution to the pollution problem, along with the land use ethic, allowed America to effectively ignore the overall implications of rapid growth and development that were taking place.

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[49] Stephen Sussna, Land Use Controls. Urban Land Institute, Research Monograph No. 17, 1970, p. 6.

[50] John Delafons, Land Use Controls in the United States. (Cambridge, Mass.: The MIT Press, 1969.) P. 28.

Land Use Controls and Planning. Land use controls during this period were changing little. However, master plans for urban and suburban growth began to develop. This could have been a breakthrough in the maintenance of environmental quality through land use planning, but, at that time, "most master plans manifested a cursory treatment of the natural and man-made environments. With plans based on projected growth and development objectives, the standard comprehensive planning process showed little, if any, sensitivity to the impact of development on the natural environment."[51]

Since "comprehensive" planning at this time was not environmentally conscious, developments and subdivisions began to appear on flood plains, earthquake faults, areas of poor drainage, wetlands that had been reclaimed, etc. They also pushed into land areas that were being used for other purposes. For example, the Santa Clara Valley in California was one of the prime agricultural areas in the state, but this period saw most of it converted to subdivision. There was still a feeling that America was the land of plenty; growth took precedence over all else.

The Environment. Environmental problems became severe during the 1950s and 1960s. An increasing number of cities began to control emissions from industrial sources, but there were no controls of automobile emissions. Up until 1955, cars had not been a significant source of air pollution, but with the increasing numbers of new highways, suburbanization in full swing, and the rise in automobile ownership, cities began to recognize air pollution problems resulting primarily from automobiles. Even after this fact was recognized, the move to control air pollution from cars would not come for at least another ten years; the lag would prove to have far reaching effects on the structure of the cities, as people began to move away from air pollution problems.

Water pollution was increasing as industries continued to dump untreated wastes directly into waterways. The increasing density of city and surrounding areas served to overload the sewage treatment systems, adding to the water pollution dilemma. At that time, water pollution received little attention, as it was not perceived by the city inhabitants to be serious. There was still a belief that water was the proper disposal medium for untreated industrial and human wastes. The United States was still growing, and as productivity increased (with a corresponding inability of the environment to absorb water-born wastes without detrimental effects), the quality of water in and around America's cities declined sharply.

The important factor in the rapid increase in the degradation of the environment was the tremendous increase in density of urban areas that our new innovations (high-rises, ease of transportation by automobile, etc.) allowed.

Suburbanization. Suburbanization was now becoming an important pressure on land in urban fringe areas. At the end of World War II, economic prosperity and standards of living were on the rise, especially for the white middle class. Since the American heritage of land ownership was most deeply entrenched in this segment of the population, there became a great demand for single family dwellings with "a front yard, a back lawn and a garden." The urban areas were not structured for this type of residential use so that large numbers of the white middle class moved to rural fringe areas. With this rising demand, new housing developments grew rapidly, and with increased ease of movement, suburbanization became the "land use of tomorrow."

As the white middle class was moving to the suburbs, there was an influx of blacks to the cities, especially in the industrial northeast. They were in much the same position that the ethnic minorities were thirty years earlier, being forced to take low paying jobs and live in poor housing. Slums continued to expand and became commonplace in large cities. As the slums grew, so did the desire of many to leave the city and its problems.

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[51] Promoting Environmental Quality Through Urban Planning and Controls, draft prepared by the Center for Urban and Regional Studies, University of North Carolina, Chapel Hill, 1973. P. II-4.

The Metropolis. With the rapid spread of the population around urban centers came our present metropolitan structure. In Urban Society, An Ecological Approach, Amos Hawley discussed the mechanism for metropolitan growth and structure: "Concentration at the point of convergence of local transportation lines develops a pressure which forces activities outward more or less symmetrically. Growth of the central business district pushes ahead of it a belt of obsolescence occupied by light industries, warehouses, and slums. This transition zone, in turn, encroaches upon a zone of low income housing, causing the latter to shift outward and to invade a belt of middle income residential properties. The latter finally spills over into suburban territory and presses against a zone of high income housing. The occupants of each zone tend to succeed to the space occupied by those of the next outer zone. At any moment in time, therefore, the distribution of land use exhibits a ring-like appearance." This process would create the major land use problem the United States would face in the early 1970s.

The 1970s and Beyond--With the spread of the metropolis came increases in population density also. Today, roughly 75% of the population (168 million people) live in a total land area slightly larger than the state of Colorado (68 million acres).

The Environmental Era. Density-associated environmental problems have also spread. Instead of being confined to inner-city areas, as they were in the past, pollution now affects the entire metropolitan area.

Air Quality. In 1968, there were over 214 million tons of carbon dioxide, particulate matter, sulfur oxides, hydrocarbons and nitrogen oxides released into the air, mostly in metropolitan areas, affecting health, vegetation, and property.

Water Quality. By 2000 it is projected that we will withdraw 900 billion gallons of water from our rivers (80% of their total flow). If our treatment facilities were totally effective, the problem would not be as severe, but they are not: today less than one-third of the nation is served by adequate treatment facilities, and one-third by no system at all. In some areas, industries continue to dump untreated wastes into streams and rivers; in other areas treatment systems are not reducing the biological oxygen demand of the sewage to a point where water quality will not be adversely affected; yet water becomes more precious as time goes on.

Solid Waste. In 1969, Americans produced over 250 million tons of solid waste, 146 million tons of which were disposed of in open dumps. Each American now produces 5.5 pounds of solid waste each day, and the rate of production is steadily rising.

Noise. The noise level of our metropolitan areas, especially the urban centers, is almost deafening. City traffic noises are now as high as 90 decibels (a level which causes hearing damage over extended periods of time).

Social. In the last ten years there has been a continued expansion of slum areas. Crime is still increasing by leaps and bounds while overcrowding and lack of space in metropolitan centers are creating both psychological and physiological problems.[52]

New Activity and Land Use Patterns. It has been clearly shown in the past that as environmental and social problems continue to grow, there will be a tendency for inhabitants to move outward, away from the source of concern. As today's population moves farther away from the metropolitan centers, demand for goods and services in the city is decreasing. We are now witnessing the rapid increase in the "shopping center" development on the metropolitan fringe so that the new demand can be met. The outward moving process discussed by Hawley is beginning to occur at these developments as they are beginning to take on the characteristics of "mini-cities."

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[52] Environmental Quality: The First Annual Report of the Council on Environmental Quality. (Washington, D. C.: CEQ, 1970.) P. 65.

In our attempt to allevaite some pressing environmental problems, we are creating others. Our new mass rapid transit systems are excellent examples: they are helping to solve the automobile-created air pollution problem, but, as it was with the inter-urban railroad system in the early 1900s and the new highway complex in the 1950s, they may well cause further outward movement of people by starting new developments around their lines.

Land Use Controls. It is evident from this discussion that land use controls based on environmental, as well as economic and social criteria are needed. Today, new methods of control such as performance criteria, density regulations, special use zones, planned unit developments, open space, and mini-max zoning are being used. New land use controls will be totally ineffective if they don't take into account their effect on the natural, as well as the economic and social environment. We can no longer afford to let growth be haphazard. Land use controls can help to prevent such growth.

The Future. As well as taking a regional, ecosystem approach, we must also closely examine our present land and growth ethics. Inexhaustability of natural resources was a myth of the past; the concept of growth for its own sake should have died years ago. Just as important, we must fully realize that the quality of our future environment rests on our land and how we use it.

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Land Use Concepts

I conceived that land belongs to a vast family of which many are dead, few are living, and countless members are still unborn . . .

A Nigerian chief

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Toward a New Concept of Land

Fred Bosselman and David Callies

If one were to pinpoint any single predominant cause of the quiet revolution it is a subtle but significant change in our very concept of the term "land," a concept that underlies our whole philosophy of land use regulation. "Land" means something quite different to us now than it meant to our grandfather's generation. Its new meaning is hard to define with precision, but it is not hard to illustrate the direction of the change.

Basically, we are drawing away from the 19th century idea that land's only function is to enable its owner to make money. One example of this change in attitude is that wetlands, which were once characterized as "useless," are now thought of as having "value." As we increasingly understand the science of ecology and the web of connections between the use of any particular piece of land and the impact on the environment as a whole we increasingly see the need to protect wetlands and other areas that were formerly ignored.

This concern over the interrelatedness of land uses has led to a recognition of the need to deal with entire ecological systems rather than small segments of them. San Francisco Bay, Lake Tahoe, the Hackensack Meadowlands, Adirondack Park are now all seen as single entities rather than as a collection of governmental units.

The new attitude toward land can also be seen reflected in the increasing concern about its scarcity. Industries that in an earlier day seemed to have their choice of an unlimited supply of land now see land as a limiting factor. With some, such as the forest products industry, this recognition came early--with others, such as agriculture, it is just beginning in states like Hawaii and California.

The economically productive users of land are not the only ones who are increasingly recognizing its scarcity. Wilderness buffs have recognized this for some time. But now the large segment of Americans who just want to live in the country, and who once seemed to have a wide choice of location, now find their supply of land limited. The jet plane, and particularly the interstate highway network, have permitted millions of Americans to achieve their goal of "country living" on either a permanent or temporary basis, but they are finding that there isn't as much "country" to live in as there used to be. Their annoyance is reflected in the new legislation in Maine and Colorado.

The scarcity of land reflects both its increasing use and the increasing limitations put on its use by local governments. The problems of inner city dwellers seeking adequate housing seem impossible to solve unless we can overcome the scarcity of suburban land on which low and moderate-income dwellings can be built. The Massachusetts Zoning Appeals Act was passed in recognition of this scarcity.

Conservationists describe the changing attitude toward land by saying that land should be considered a resource rather than a commodity. But while this correctly indicates the direction of the change, it ignores the crucial importance of our

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From The Quiet Revolution In Land Use Control: Summary Report, prepared for The Council on Environmental Quality by Fred Bosselman and David Callies, 1971. Pp. 21-25.

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constitutional right to own land and to buy and sell it freely. It is essential that land be treated as both a resource and a commodity. The right to move throughout the country and buy and sell land in the process is an essential element in the mobility and flexibility our society needs to adjust to the rapid changes of our times. Conservationists who view land only as a resource are ignoring the social and economic impact that would come with any massive restrictions on the free alienability of land. But land speculators who view land only as a commodity are ignoring the growing public realization that our finite supply of land can no longer be dealt with in the freewheeling ways of our frontier heritage.

The idea that land is a resource as well as a commodity may appear self-evident, but in the context of our traditions of land use regulation it is a highly novel concept. Our existing systems of land use regulation were created by dealers in real estate interested in maximizing the value of land as a commodity. Subdivision regulations which encouraged uniform lots fronting on public streets enabled land to be divided into tradable units. Traditional zoning ordinances with only a few use districts, each governed by relatively nondiscretionary regulations, attempted to give these lots some of the fungible qualities of corn futures or stock certificates, making it possible to determine in advance the specific type of use permitted on the land and providing quick shorthand labels for identifying various categories of land. Bulk and yard regulations created an envelope on each single lot which enabled the owner of that lot to build without further consideration of the relationship of his land to the land of his neighbors, thus assuring potential buyers of the land's usability. The highest goal of the system was to enable barkers to sell Florida lots in Grand Central Station.

The promoters of these land use regulations in the 1920s made no attempt to conserve land for particular purposes or to direct it into a specific use, but only sought to prevent land from being used in a manner that would depreciate the value of neighboring land. The traditional answer to the question, "Why regulate land use?" was "to maximize land values." To achieve this purpose they sought to restrict those uses of land that adversely affected the price of neighboring land by concentrating them in specific parts of the city.

Where development would not harm property values it went unregulated. Zoning permitted residential uses to be built in the most polluted industrial districts on the theory that any development which did not reduce the value of the surrounding land should not be prohibited. Land use regulation was limited to urban areas where the close proximity of land uses made it likely that the particular use of one man's land might reduce the value of another's, but there was no regulation of land outside urban areas where such a reduction in value was not likely to take place.

In a dynamic and mobile society such as ours the ability to buy and sell land readily is an essential ingredient in the operation of the system, and the extent to which zoning and subdivision control have been adopted throughout the country testifies to the usefulness of these original concepts. The last 20 years, however, has seen increasing recognition that the purpose of land regulation should go beyond the protection of the commodity value of land. A realization is growing that important social and environmental goals require more specific controls on the use that may be made of scarce land resources.

This recognition is seen not only in the new state role in land use regulation, but in the actions of many local governments. Modern zoning ordinances typically rely less and less on pre-stated regulations and require developers to work with local administrative officials in designing a type of development that fits more closely into the specific circumstances of the surrounding neighborhood. Similarly, regulations tend to encourage larger scale development in which the various land uses are arranged and designed according to a comprehensive plan for the specific site, as opposed to the traditional lot-by-lot development under which individual lots were sold to individual purchasers who might develop each lot according to pre-established rules. More specialized use districts, which permit only those uses appropriate to a specific geographic area rather than some abstract category of uses such as M-1 or R-4, are also evidence of local governments' growing attempt to tailor land use regulations to local needs.

Most importantly, perhaps, numerous systems of local land use regulation are beginning to contain regulations that recognize land as a resource as well as a commodity. Exclusive agricultural and industrial zoning preserves land as a resource for these important uses. Regulations prohibiting topsoil removal or requiring common open space find their justification in the protection of land as a resource for recreation and beauty. Regulations which require that a specified percentage of dwelling units in each housing development be reserved for low-income groups are recognizing the importance of land as an essential resource for housing all elements of our society.

Recent years have seen a rapid increase in local zoning and subdivision regulation in relatively undeveloped areas. Here the concern is not that the use of land might injure immediate neighbors, but that it might impair the possibility of more desirable long-range land use patterns. Increasingly the question being asked is not only, "Will this use reduce the value of surrounding land?" but "Will this make the best use of our land resources?"

The clearest evidence, however, that there has been a change in the attitude toward why land should be regulated is in the legislation. . . . . The purposes sought to be achieved by the various bills are a far cry from the simple value-maximization concepts of early real estate interests. Hawaii seeks to conserve the land for agriculture and to preserve scenic beauty. In Tahoe and San Francisco the goal is to preserve the amenities of the area. Maine and Vermont are trying to protect the rural atmosphere of their states. Massachusetts wants to preserve some suburban land as a resource for low and moderate-income housing and to preserve wetlands as a resource for wildlife and other ecological values. In the Hackensack Meadows the goal of New Jersey is to utilize this centrally located land for the ideal combination of development and conservation purposes.

But the recognition of new purposes for regulating land should not and does not mean that the old concerns with land's value and salability should be ignored. On the contrary, the longer-range view expressed in the new land regulatory systems will enhance land values over the long run to a far greater degree than systems motivated primarily by a desire to increase immediate salability. The preservation of the amenities of San Francisco Bay is of tremendous economic value to all landowners in the Bay area. The preservation of the quality of Maine's lakes and coastline will be of great value to owners of property in those areas, not just today but for years to come. Today's broader view of land values recognizes that in the long run land values will reflect our ability to maintain a society in which people will want to own land, and this is the overall goal of the legislation now being enacted by the states.

Land in Our Daily Lives

Marion Clawson

From time immemorial, men have travelled the seas and made use of the lakes and streams, but Man is essentially a land animal. At one time land was basic for the personal income and security of all men everywhere, and even today it is the mainstay of most of the people in most of the world. Land was and is both a means of earning current livelihood and of providing for one's family. In many times and places, land has meant social position and political power as well as economic advantage. Tribes and nations have fought wars over land throughout history. Social systems, laws, and customs have all been concerned with one or another aspect of land. Land permeates every society and economy--playing a somewhat different role in less-developed economies than in the more developed ones.

In the United States today, at one level of intellectual perception, we may seem to have moved beyond this age-old concern over land. A man today may earn a living, have ample economic security now and for his old age, have a secure and advanced social position, and have significant political power, all without owning a foot of land. Our society and economy have developed in a different direction, and these measures of personal well-being are attainable by means other than landownership.

But this apparent freedom from dependence on land, or this apparent indifference to land, is deceptive. All economic and social activity in the United States has a place dimension; it all requires some land. True, a person need not own land; he may rent it, or rent structures based on it, or obtain the use of land under other arrangements. But the population as a whole is still closely dependent on land for food, fiber, shelter, and the amenities; the ultimate source of food is not the supermarket, but the land. The competition for use of land in the United States is strong and rising; land policies are still important.

The total land area of the United States is fixed (with minor exceptions, such as filling of swamps or bays) while the total population has grown and is growing. With the numerator of the land/man ratio fixed while the denominator increases, the laws of mathematics result in a smaller and smaller land area per person. Does this somehow mean that we are "running out" of land or that the supply of land is getting dangerously low?

Our concern, as individuals and as citizens, is not really with the acreage of land, but with the products and services of land. These depend not only on the area and the characteristics of the land, but also upon the inputs of labor, capital, management, and technology into various productive processes. The volume, variety, and scope of these inputs has risen greatly over the years, and promises to rise more in the decades ahead. As a result, the products and services of land are not in danger of running out, and the total land situation of the United States is relatively comfortable.

Nevertheless, there are problems in land use--problems about which every alert citizen should be informed, since as a voter and as a participant in society he

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will have to take positions and actions about land. In particular, the supply of desirable land in choice locations is no longer plentiful, and there are serious problems of land degradation and misuse to be corrected.

The comfortable position on land in the United States today may not extend forever; if population continues to rise at an unchecked rate, the day will come when sheer space per person will be a stringently limiting factor. But that day lies a relatively long way in the future. As a nation, we may, for various reasons, wish to limit our population in the interests of the quality of life for those who do live here, but it will be some time before sheer land area becomes the controlling factor.

Land Supply per Person

In 1970 the average person in the United States had the products and the use of about 11 acres of land. Some of this land is desert in the West, some is tundra in Alaska, and some is nearly barren mountain tops; but some is fertile cropland in the Corn Belt and elsewhere, some has magnificent forests, and some is the highly valuable land of our towns and cities. This is the land on which we live, work, and play, and from which we get our food and forest products. Some of it is in highways, airports, and other necessary uses for modern living. This land is owned by various persons and groups, but all of us benefit, in one way or another, from its existence and from its productivity.

Many persons may be uncertain about how much land 11 acres is, and a few comparisons may be helpful. It is about three average-size city blocks; it is 22 or more generous size suburban home lots. (An acre contains 43,560 square feet; the playing area of a football field is 300 by 160 feet, or 48,000 square feet, or 1.1 acres.)

By world standards, the people of the United States are extremely fortunate in their land heritage. Our total land surface per person is almost exactly the same as the world average. But our land is on the average vastly more productive than that for the world as a whole. Not more than 10 to 15 percent can reasonably be classed as wasteland; even the deserts, tundra, and mountain tops often have some value for wildlife, mineral production, watershed, or other purposes. Among the other large countries of the world, Russia and Canada have a higher percentage of their land in Arctic or near-Arctic lands with only the most limited productive capabilities; Brazil has a vast Amazon jungle which is just beginning to be exploited; Australia has a vast "dead heart" of desert or near-desert; and China has large areas of desert or near-desert.

The acreage of cropland presently used for crops and rotation pasture exceeds 2 acres per capita in the United States, and there is enough potential cropland for a total of about 4 acres per capita if the need were acute. Few other urbanized and industrialized nations have anything like such a generous endowment of good cropland per person, and in many of the densely populated countries of Asia and the Middle East the figure is well below an acre per person. A large part of our favorable position is due to our relative youth as a nation. The early settlers found a highly favorable environment on the North American continent, and their technology and skills enabled them to exploit it.

Overall Land Use Situation in the United States

The "big three" of land use, on an area basis, are cropland, pasture and grazing land, and forest and woodland; but the "important two" in terms of value of land and relationship to the daily lives of many people, are urban and recreation....

There has never been a land use inventory in the United States that included every tract of land classified according to a uniform system. Data on land area used for various purposes come from censuses of agriculture, censuses of cities and local governments, records of federal land managing agencies, and various other sources. In spite of efforts to use comparable definitions, there is reason to suspect that omissions and overlaps occur and that the reported figures for each category are not always accurate. . . . Some of this "unaccounted for" land is idle by any reasonable test. But there is idle land in other categories as well.

Some cropland is idle, largely because its idleness has been paid for and encouraged as part of a federal program to reduce cropped area and thus reduce agricultural output to market demand; some grazing and forest land is also largely idle, producing little and being used little or not at all; but by far the most important idle land is acreage near cities, and sometimes within their borders, held speculatively for increases in price.

A chart showing land use at 10-year intervals would show relatively constant land use in the United States since 1920. When the data for 1969 are published in 1972 or 1973, they will show essentially the same picture, slightly modified by a trend toward somewhat more urban and recreation land and somewhat less cropland. Moreover, the best estimates of land use for the decades ahead suggest a closely similar picture until 2000 or later. This is simply another way of saying that the great land use changes of the nineteenth century had largely run their course by about 1920. Since then, the overall statistics have shown only modest changes. However, this picture of modest change is misleading in many respects. Some overall changes have occurred: land used for cropland purposes has declined in the past decade, recreation and urban areas have increased greatly in percentage terms but are still small compared with the total land area of the nation, and other net changes have taken place. In cases where changes on some land, in some places, have been offset by opposite or different changes on other land in other locations, the "net" figure, however, tells only a small part of the story.

A corollary of the relative constancy in land use is that when changes do come, they often come hard. In the days of the frontier, a piece of land could be transformed from forest or open prairie into cropland without disturbing anyone very much; today, when a superhighway is built through an urban area, thousands of people may be disturbed, and some may lose their homes; controversy is inevitable, however beneficial the change may be overall. Land use changes in the future will generally be still more difficult--upsetting to many people, hence resisted, while at the same time beneficial to others and supported by them. A country, no less than a person, encounters new problems as it sheds the old ones.

Size and Diversity

Visitors from other lands are often amazed to find that the United States is so big and that its land types are so varied. Many Americans might experience the same feeling if they were to drive across the country instead of flying across it so high and so fast that they scarcely realize what lies beneath. Anyone who walks along our seashores, or on our farms, or visits ranches, or hikes through some of our better forests, or backpacks or canoes into the back country will soon begin to get a better idea of the vast distances.

But diversity of physical land type is as striking as distance and area. In topography and relief, our country varies from mountain ranges, especially in the East and West, to great rolling plains, to swamps and river valleys. In climate, it varies from deserts to very high rainfall in some areas, cold winters and permanent underground ice in northern Alaska, and scores of variants between. Death Valley lies below sea level, hot and nearly desolate, while less than 100 airline miles away Mount Whitney stands cold and bare as the highest point in the 48 conterminous states. As a result of climate and topography, soils development has been quite different in different regions, varying from no true soils in much of the desert and low-rainfall areas to deep well-developed soils with rich organic matter in some of the prairies and erstwhile forests. Reflecting all of these factors and more, the native vegetation ranged from magnificent forests of many types, to tall and short grass prairies, to desert shrubs.

One could go on and on, reciting true and dramatic facts about our land. Even one who has travelled widely for many years, and reads a great deal, is from time to time amazed at some natural feature of some part of the United States. It is utterly impossible to attempt to describe even the major parts of the United States in adequate detail. One can only try to arouse the interest of the reader, to find out for himself, by direct personal experience or by reading the experiences of others, more about the land.

This matter of size and diversity of the United States has been introduced here for a different reason. With such diversity in physical land type and in use, it is dangerous to generalize without warning the reader that large and significant exceptions exist. It is necessary to consider land use on a broad basis. It is entirely valid to use national statistics or talk about national totals and national averages, but generalizations must be appreciated for what they are. The statement that there has been little change in land use in the United States does not mean that there has been little change in every county in every state. For every generalization, there are exceptions, and sometimes exact opposites.

Man Has Left His Mark

The early European settlers and those who came after them have left their mark on present-day America. Extensive areas of forests were cleared, sometimes by burning magnificent trees merely to get rid of them; forest lands and prairies were plowed, and left vulnerable to erosion. The grazing of domestic livestock on native forage grasses and other plants often had serious effects upon the plant cover; and some species of wild animals have nearly disappeared.

Man has built reservoirs to store water for his needs, and in so doing has brought about major ecological changes in the reservoir areas. Through irrigation, he has transformed some deserts and dry areas into farmland and others into salty areas or swamps. He has built great cities, and he has polluted the air around them. And the wastes from the cities and from industry and agriculture have led to the pollution of many rivers, streams, and lakes. All in all, modern Man has drastically altered the natural scene that his colonial ancestors found in the United States; he has also developed an economy and a society of high economic output and of luxurious personal consumption.

The Indians whom the Europeans found on this continent--and who were themselves immigrants whose forebears came from northern Asia many thousands of years earlier--lived more nearly with the land, conforming their actions and lives to it, rather than trying to change it as the Europeans did. Lest one credit the Indians with more respect for Nature, it should be realized that they lacked many of the tools for massive modification of the natural scene. Until the Spaniards introduced horses, cattle, and sheep, the Indians lacked animal power and domestic grazing livestock; they never had the wheel or the plow, to say nothing of the bulldozer. They did have fire, and they used it as a conscious tool of resource management. Extensive prairies are believed to owe their existence to repeated burning because grasses were resistant to fire and trees were not. In other situations, forest productivity was sometimes improved by fire.

The European colonists had the technical, physical, and economic power to produce change in the natural landscape they found, and they used their power. The colonial ax may seem a feeble tool compared with the modern bulldozer as a means of clearing a forest, but in combination with fire it was the means whereby millions of acres of forest were cleared. Wooden plows pulled by oxen may likewise seem a feeble tool for land cultivation compared with modern tractors and plows, yet a lot of land was first plowed by such tools. In scores of ways, modern Man has further modified the natural environment--raped or ravaged it, some would say. But he has made some land more fertile than it was when he first found it.

It is also true that modern Man has devised institutions and mechanisms for managing and preserving land that his colonial ancestor lacked. The rise of soil conservation as a social and resource movement, the development of the national forest concept, and the establishment of national parks--the latter now imitated in many countries throughout the world--were all manifestations of the desire to find ways of managing the natural resources to meet the demands and challenges of the present and of the future.

This brief overview of resource history in the United States shows that we do not start with a clean slate today. Our task is somehow to reconcile the demands of a large and growing population with the health and condition of its natural resources. We cannot retreat to the natural environment that our colonial ancestors found, even if we wished to do so. For better or worse, we have replaced nearly all the buffalo with cattle, and our future management problem for the Great Plains lies with the cattle. We cannot avoid stream pollution by keeping everyone out of every watershed, for all land is watershed and there is no place else to live and work. The resource management problem of the future is by no means hopeless in my judgment, but its solution lies in going forward, not in trying to retreat to a bucolic past that was probably a less happy situation than is sometimes idealized.

Land Use Is a Public Matter

Land use in the United States is controlled or influenced by public action to a greater degree than most people realize.

About a third of our total land area is publicly owned. . . . Most of this publicly owned land is owned by the federal government, and some by states, counties, cities, and special districts. There are good reasons to expect that the area of publicly owned land in the United States will increase, not decrease, over the decades ahead, although the changes may be small on a percentage basis. Comparatively little of the land now publicly owned will be disposed of to private owners; as a nation, we have concluded that some types of land are more likely to be used wisely if publicly owned than if privately owned. Some land now privately owned is almost certain to come into public ownership to be used for highway rights-of-way, parks, and reservoirs. If the nation gets into massive slum clearance and urban renewal, there could be a sizable increase in the area of publicly owned land in the hearts of our larger cities.

Most of the land in the United States is, and will remain, privately owned. However, government at all levels--federal, state, and local--has extensive powers over the use of private land.

First, government can exercise its power of eminent domain to take private land needed for public purposes. Prime examples of the use of this power arise with respect to highways, slum clearance, and park additions. The government's power is nearly unlimited, subject to the requirement that the land is needed for a public purpose. The courts have argued about "public purpose" many times in the past; and some land uses--slum clearance, for example--are today acceptable when once they would not have been. The private land so taken must be paid for, of course; and the private landowner can always insist upon a court-determined price for his land, which in practice has often meant a relatively generous price. What makes the power of eminent domain so important is not the area of land taken, which has been rather small and presumably will continue to be small, but the strategic nature of the lands and the coercive nature of this power.

A second basic governmental power over land is taxation. In our American system of government, taxes on land are not levied by the federal government and are not levied by many states, but real estate taxes are often the mainstay of local government. Every property owner pays taxes directly; every tenant helps to pay his landlord's taxes. Thus taxes on land and its improvements affect almost everyone. Taxes are also one of the largest costs of land ownership; they not infrequently take a fourth, a third, or even a half of the income from the land. It is not only their amount but also the way in which they are calculated and collected that may affect the landowner. In suburban and urban areas, desired governmental services, such as schools, libraries, and parks, can often be obtained only by use of real estate taxes. The homeowner is often caught between his desire for better governmental services of some kind and his dislike of paying more property taxes.

A third basic governmental power over land and landowners is the police power. The most common use of this power is in zoning ordinances. These tell the landowner what he may not do with his land, and thus by inference tell him what he may do with it. A prime purpose of zoning ordinances is to protect landowners and users from nuisances or other undesirable uses on the land in the locality. Zoning may prohibit industrial or commercial activity within a prime residential neighborhood, for instance. The value of any tract of land is in large degree determined by the uses made of surrounding or nearby areas. Zoning has most often been applied to present or potential urban and suburban areas, but it has also been applied to some rural areas. Subdivision regulations are another use of police power. By establishing minimum-size building lots, the unit of local government largely controls land use. Police power is also used as the basis for building and health codes aimed at protecting people from substandard residential structures.

The fourth, and by far the most important, basic governmental power with respect to land is the power of the public purse. Both land use and landowners are materially affected by the way in which governments at all levels, but especially the federal government, spend funds for various public purposes. The variety of such programs is so great and their scope so large that they are perhaps the most influential single force affecting land use in the United States today.

Government finances a great deal of research, which is available to landowners and others free, and which often greatly affects the decisions they make about use of their land. Government carries on some resource-managing activities directly--flood protection, irrigation, and others, which enable private landowners to carry out activities that would otherwise be difficult or impossible. The federal government has heavily subsidized highway construction, airport construction, and, especially in an earlier day, railroad construction. It has also subsidized electric power production and transmission, the latter especially into rural areas. It has provided financial help for forest fire control and for some other forest programs. And it has provided direct payments to millions of farmers to carry out soil conservation measures, to reduce crop acreage, or to carry out other programs. As a result of some of the farm programs, millions of acres of cropland have been taken out of active use and are largely idle today.

Changing Space and Land Use Relations

The enormous scientific, technological, social, economic, and political changes of the past two generations have greatly altered the space relationships among land tracts or areas, and the land demand-supply situations have accordingly been modified greatly. The one constant about land is its position with reference to the North Pole, the equator, and other land and water masses. Other physical features of the land may change--its forests may be cut, its soils may erode, or its surface may be paved with impervious asphalt or concrete.

Over the centuries, a major revolution in communication and in transport has both shrunk and expanded the world--shrunk it, in terms of permitting travel and freight shipments over long distances, and expanded it in the sense of opening up new areas for the use of people resident in any particular location. . . . Air travel cut this time distance sharply, and jet planes reduced it further. These comparisons apply to cross-country travel only. . . .

The results of this shrinking of economic space have been considerable for nearly all kinds of land uses. Distances, and costs based upon distance, are still important factors affecting land use. But, to a substantial degree, we now have national and regional markets for land and its products, whereas formerly we had local ones. Most agricultural products and many or most forest products move in a national market now. People seek outdoor recreation hundreds of miles from their home. With nearly universal automobile ownership, even the corner grocery store is exposed to competition on a wider basis. This reduction in travel times and costs has greatly increased the effective supply of land; it has also greatly increased the demand for land in the more remote locations. There are few sheltered areas today; in a remote wilderness area, one can see planes and satellites go overhead. Land problems of all kinds must increasingly be studied from a national viewpoint; the environment of each area is determined in part by conditions in other areas.

Quality of the Environment and Land Use

In the past decade or so, there has been a dramatically rising tide of popular concern over the quality of our environment on this earth. Man has developed a highly productive economy, which supports several billion people, some in luxury. By and large, little attention has been given to the impact of this production process upon the natural environment. The goal of the production process has been to provide goods and services for the consumer; the production man has sought to coax or beguile people into buying, and the economist has measured output in terms of what reached the consumer. Very little attention has been paid to the uses the consumer actually made of the product or service; there have been constant complaints about the quality and cost of service for autos and household gadgets. But still less attention has been paid to the wastes or the residuals from the consumption process.

This concentration on production for the consumer was misguided and incomplete. Everything that reaches the consumer shows up again in some form as a residual--waste, in more popular but less accurate terminology. The tonnages of inputs, whether measured to the individual or to a city or other large area, must be matched by the tonnages of the output. The latter may be gaseous, liquid, or solid, and many residuals may be shifted from one form to another, as when household paper wastes are burned to create added air pollution. The residuals from some processes may be valuable inputs to others.

This matter of quality of environment goes far beyond land use, and cannot be explored fully. . . . It seems highly probable that people will demand new approaches to environmental problems, although it is as yet far from clear that all the protesters are willing to pay the costs, which may be considerable. In this larger picture, land use cannot remain unaffected. Some land will be used for landfill or for garbage dumps. But agricultural or suburban development practices that dump a lot of sediment into streams may well be curbed; and the poultry producer or beef cattle feeder, whose operations contribute to the mineral load of waters and thus to the growth of algae there, may also feel some restrictive hand. In scores of ways, an effective demand for a cleaner and more attractive natural environment may affect land use.

The General Shape of the Future

Land use will undoubtedly be affected by a number of demographic, economic, and technical trends that are now under way.

The United States will surely have more people in the future than it has today, assuming no catastrophic war. The 1970 Census shows about 205 million people. A few years ago, most population projections for 2000 included at least 300 million people, some considerably more than that. Since 1960, the crude birthrate (the number of births per 1,000 population of all ages and both sexes) has declined by a fourth, and today most forecasters would probably estimate somewhat fewer than 300 million people by 2000. If birthrates continue to decline, the number at the end of the century could be considerably less than 300 million. However, even if by some miracle the birthrate declined tomorrow to a point that would ultimately mean a stationary population (and it would not have to decline so very much further, to reach this level), the relatively large numbers of young people in our population would ensure a continued population increase for at least two or three decades. For our purposes, it does not matter what the exact population figure will be in 2000 or--to put it differently--the exact date at which any reasonable number will be realized. It seems almost certain that there will be more Americans at the end of the next generation than there are now; and their sheer numbers will put increased demand upon land resourses.

There is a widespread consensus among economists that real incomes per capita will continue to rise in the future at more or less the rate of the recent past. Between 1970 and 2000 disposable personal income per capita in real (constant price) terms (which is a measure of buying power) is likely to rise by more than half at a pessimistic low to slightly more than double at an optimistic high. In terms of 1970 prices, average family incomes might reach $20,000 by 2000. For our purpose, it is not necessary to estimate precisely how large the increase will be. The very fact that there are more people with more money will mean an increased demand for a wide variety of goods and services, and some of this increased demand will fall on products from the land. The category least affected by higher average incomes will be cropland because the demand for so many agricultural commodities is not sensitive to increases in consumer incomes. The demand for outdoor recreation, in contrast, will almost surely continue to rise greatly; more people with more money to spend spells greater attendance at many public parks.

Increasing affluence has meant--and probably will continue to mean--an increased impact upon the natural environment. Greater output has required higher energy consumption, for instance; and whether the energy came from coal, oil, gas, or some other source, the additional energy has had impacts upon the environment, both in the area of origin and in the area of consumption. One of the major problems of the future is to devise ways of achieving a high economic output for high material standards of living, and at the same time minimizing the impact upon the environment.

The twentieth century may later be looked upon as the period of the knowledge explosion. Free public education was established as a principle during the nineteenth century, but the idea of universal attendance through high school is a twentieth century phenomenon, and the idea of nearly universal college attendance may well be established by the end of the century. Scientific and technological research are now firmly entrenched in every branch of industry. All of these trends will almost surely continue. We may have lost some of our naive faith, or hope, that increased knowledge would solve all our personal or social problems; but we are firmly committed to knowledge as a desirable means of solving problems. A continued growth in knowledge will surely affect land use; the current forecast that increased production per acre of cropland will meet all increased demands for agricultural commodities for at least a generation ahead, for instance, is based on the assumption that agricultural research will continue.

A greater degree of urbanization also seems highly probable, if not certain. The trend has been strongly in that direction for a long time; it is accelerating, not diminishing. There is indeed widespread criticism of the city as a form of human settlement, and the large city in particular; but it is also true that people continue to migrate to such cities. There might be a successful program to modify the present population distribution between very large, large, and medium cities, although even this would be an operation of heroic proportions; but it seems unlikely that there will be a program to reverse the flow of people to cities.

But urbanization is more than a matter of people crowding into relatively compact living patterns; it is also a style of life, or an attitude toward life. In this sense, many American farmers today are urban; college-educated, well-informed, travelled, they are no longer rural in the older sense of the term. Personal consumption habits and personal life styles will almost surely grow more similar to those of people in the larger cities.

All of this points to a society and an economy with greater interdependency among its members in economic, social, and land use terms. Land use within an urban complex today is highly interdependent--what is done on one tract is greatly influenced by what is done on other tracts, and in turn exerts its effects on still other land. This type of interdependence will almost surely grow stronger over the next generation. We may be able to find ways of reducing the negative external effects and increasing the positive ones in a democratic manner. Planned cooperation might produce a more desirable living environment than any individual could achieve on his own. But increased interdependence almost certainly will mean more public controls over private land. The development of zoning over the past generation may have a parallel in the development of stronger and more diversified controls in the future. With more people, larger population concentrations, and a greater social and economic interdependence, it becomes more and more unlikely that each individual will be able to pursue his own ends wholly in his own way. The real issue is to find ways of exerting social control with a minimum of stress and interference on the individual.

A major social attitude of the future is likely to be an increased concern over the quality of the natural environment and a willingness to do something about it, even at a cost. In the past, most people have been more concerned with obtaining the products and services of technology and of the economic machine, and have shown little or no interest in what the production of these goods and services was doing to the natural environment. People wanted big automobiles, fine television sets, a wide variety of household gadgets, enough electricity to run their machines, and a great assortment or other consumption goods; only recently have they begun to worry about what happened to these articles once they were no longer useful, and about what happened to the environment during their production. In the past decade, more particularly in the past five years, there has been a great hue and cry about pollution, waste, ugliness, impairment of the environment, and the like; but it remains to be proved that the electorate as a whole will support effective measures to do something about the problem. Are people really willing to pay higher prices for articles they buy, or higher taxes, or both, to provide a better environment? Surely, some people have not thought it inconsistent to scream for a better environment while continuing personal consumption habits responsible for environmental degradation.

Probable Trends in Land Use

The most striking aspect of the outlook for land use is its overall stability for a generation or more. (A chart showing land use in 2000 will almost surely look very much like . . . how land was used in 1964.) Net changes from one use to another will be too small to change the general picture. Should some book be published in 2002 with two charts on land use, one for 1964 and the other for 2000, and should the printer reverse them, probably no one would notice. The overall stability will apply to specific tracts of land also--downtown Manhattan will remain urban; most good Iowa cropland will remain in crops; and so on.

The area of land used for some purposes will increase. This will be particularly true for land in urban, recreation, water storage, and some miscellaneous uses. The area used for these purposes may even double by 2000. While this is a relatively large increase for these particular uses, it is still small in the overall land picture. The exact increase in urban area will depend on total population increase, upon the proportion of the increased population that locates in an urban setting, upon the pattern of settlement within the city (especially the lot size and the use of apartments in suburbs), upon the amount of idle land within the generally urbanized areas, upon the rebuilding of decadent older urban areas, and upon other factors. For some purposes it is highly important to estimate exactly how much land will be used by the cities or will be withdrawn by them from other uses; but any reasonable estimate of these factors will not modify the general picture of land use enough to invalidate the foregoing statements about general stability in land use. The total area used for recreation will also be determined by many factors; if the rising demand is met by increased land area, the proportionate increase could be rather large, and yet not change the general picture significantly.

The acreage used for cropland is likely to remain about as now until 2000 or later. Some cropland will be lost to expanding cities, and some of the poorer cropland will pass out of production. But some land will be brought into cropping by additional irrigation or by clearing of trees, and some by new technologies that increase productivity to a profitable level. The net changes will be small; the increased demand for agricultural commodities can be met more economically by increasing output on present cropland. Indeed, the continuing problem will be actual or potential crop surpluses. Even the gross changes will not be large in proportion to present cropland area.

There will be some net losses in grazing and forestry land areas because it is only in rare cases that either of these uses can compete effectively for land that is in demand for urban, recreation, or cropping use. Grazing is nearly always low man on the totem pole of land uses and gets its large area largely by default. Forestry, on the whole, produces a larger annual economic output per acre than grazing does, but has about the same competitive strength. Some of the increased urban area over the next generation will come out of land now classified as used for forestry. But an area that represents a large percentage increase for urban land use will be a very small loss for forestry; moreover, most of the forest land so converted will be land that is not very productive now. The inroads of recreation upon forestry and grazing may be more serious, and will more frequently arouse opposition from the industries losing land, but a doubling of recreation areas would still take a relatively small percentage of forestry and grazing land.

Some Paradoxes in the Competition for Land

Overall stability in land use seems probable for the future; yet, paradoxically, change in land use is likely to produce more controversy and general turmoil in the future than in the past. The very forces that bring stability also bring a degree of rigidity. The general picture that emerges from this book is one of enough land to readily meet the demands on it for at least a generation--no attempt is made to look further ahead. But this generally comfortable picture may be somewhat misleading; there are already some problems, and they may grow more serious. Merely to say that a person's general health is good does not prove that he has no need of medical or dental attention.

Some of the land use problems were noted in earlier chapters: a lot of land withdrawn by cities from other uses, yet idle and unproductive; a lot of decadent older urban areas; not enough recreation land in total, overcrowding of some recreation areas, serious deficiencies in the supply of parks in the lower-income parts of cities; some crop, grazing, and forestry land eroding or otherwise deteriorating, and some without adequate stands of grass or trees. One should not minimize these problems; they demand and justify more attention and greater investment than they have received. But the United States is still generously supplied with land; we can no longer use it so lavishly and with so little thought for the future, as we once did.

Changes in land use will come with increasing difficulty in the future. The area used for highways may be less than one percent of the total land area, yet for each acre converted from residential to public highway use, the conversion is 100 percent. Even where the conversion is from one private owner to another (rather than from a private to a public owner, as above), the repercussions of the land use change may be considerable. In this day of interdependencies in land use, it is not uncommon for many persons to have an interest in a tract of land that they neither own nor actively use. For instance, let there be a proposal that some of the land surrounding an old house be rezoned to permit construction of an apartment house; scores or hundreds of citizens, concerned with the effect of the proposed construction on the general character of their neighborhood, or on street traffic, or on crowding in their already full schools, or other aspects of community life, will turn out to oppose the rezoning action if a public hearing is held. Or let there be a proposal to use a swamp or marsh as a landfill area for disposal of solid wastes; again, there will be scores or hundreds of citizens who do not own the land and may never have set foot on it who will feel that they have an interest in the land use and will oppose the change. The electric power companies have found it increasingly difficult to locate power stations and power lines; too large a sector of the public has an interest in every possible location for such plants to be located without objection.

The stability and the interdependencies in land use will increase the difficulty of land use changes. Calculations of relative economic values may have some influence, but in many cases the people who will be disadvantaged by a land use change will be unmoved by an economic calculation showing that the national or community welfare will be increased by the change; they lose, and they oppose. The losses may be hard to evaluate. For instance, what harm does the public or a segment of it suffer if an old house with historic and architectural charm is torn down and replaced by a filling station or a shopping center? Some people may feel that they are worse off because they have lost something that enriched their lives; others may consider that the change has left them better off.

We are likely to see increasing public controls over private land use; the externality relationship will increase in importance and will demand more concern for the general public not directly involved in an existing land use or in a proposed change in land use. The private market will still remain important, although increasingly conditioned by public controls and public incentives. The political process (using this term in a very broad sense) will determine or at least strongly influence many land use decisions. One of the major tasks for social engineering for the next generation is to find ways of bringing all interests to bear on land use decisions and to reconcile opposing and mutually exclusive interests in a better way than we do today.

Another interesting aspect of the present land use situation, and one related to the stability of land use, is the rising competition for land, as measured by land prices. The total value of farm real estate has doubled since 1954; the price of good recreation land has risen at least as much; and the price of land in and around growing suburbs has risen still faster.

Governmental action has, directly and indirectly, greatly stimulated these increases in land value. An indirect influence has been the widespread conviction that governmental policy will never permit a repetition of the 1930s or of earlier great depressions. This has led to a confidence in future prosperity and in future worth of property that has affected land values, although it is difficult to express its importance in quantitative terms. More direct governmental actions have been the agricultural programs under which farm owners received substantial payments because they owned land, income tax provisions treating capital gains more tenderly than ordinary income and permitting real estate taxes and interest paid on mortgages to be deducted from income, and guarantees to savers and to lenders, which increased the flow of capital into real estate. Once land values begin to rise, the process is self-fueling; as long as prices rise, ownership of land is remunerative, irrespective of current income. In a great many situations in the United States today, land prices have been bid up to a point where the net income from the use of the land represents a very low return on the value of the land. If the land were sold and the money invested elsewhere, the interest on the investment would exceed the net income that is received from the use of the land. However, a decline in land values is unlikely as long as general prosperity continues.

Nature in the Metropolis

Ian L. McHarg

The discussion on matter and cycles may have appeared as an unnecessary excursion into biophysical science. Was it really necessary? Consider. The arguments that are normally mobilized in plaintive bleeding-heartism are clearly inadequate to arrest the spread of mindless destruction. Better arguments are necessary. The accumulation of some evidence of the ways of the working world produces an effective starting point. In the remarkably unsuccessful early years of my battles against the philistines I found that proffering my palpitating heart accomplished little remedy but that the diagnostic and prescriptive powers of a rudimentary ecology carried more weight, and had more value.

If we can assume that the reader has left the metaphorical space capsule with the same understanding of some basic physical and biological laws as the astronaut, we can assume that his interest in nature is not even remotely sentimental. We can now assume his solicitude for these indispensable processes as intelligent self-interest. We can also expect that the initial proposition now evokes a deeper understanding and acceptance--nature can be considered as interacting process, responsive to laws, constituting a value system, offering intrinsic opportunities and limitations to human uses. Now better armed, we can take our knowledge of nature as process and apply this to a problem--to discern the place of nature in a metropolitan region.

Some years ago I was asked to advise on which lands in the Philadelphia metropolitan region should be selected for open space. It became clear at the onset that the solution could only be obscured by limiting open space to the arena for organized sweating; it seemed more productive to consider the place of nature in the metropolis. In order to conclude on this place it appeared reasonable to suggest that nature performed work for man without his investment and that such work did represent a value. It also seemed reasonable to conclude that certain areas and natural processes were inhospitable to man--earthquake areas, hurricane paths, floodplains and the like--and that those should be prohibited or regulated to ensure public safety. This might seem a reasonable and prudent approach, but let us recognize that it is a rare one.

Consider that if you are required to design a flight of steps or a sidewalk there are clear and stringent regulations; there are constraints against the sale of cigarettes and alcohol to minors, society reacts sternly to the sale or use of narcotics and there are strong laws to deter assault, rape and murder. And we should be thankful indeed for these protections. But there is no comparable concern, reflected in law, that ensures that your house is not built on a floodplain, on unconsolidated

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From Design With Nature by Ian L. McHarg, published for the American Museum of Natural History by Doubleday/Natural History Press, Doubleday and Company, Inc., Garden City, New York. Paperback edition, 1971. Pp. 55-57.

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sediments, in an earthquake zone, hurricane path, fireprone forest, or in areas liable to subsidence or mudslides.

While great efforts are made to ensure that you do not break an ankle, there are few deterrents to arrest the dumping of poisons into the sources of public water supply or their injection into groundwater resources. You are clearly protected from assault by fist, knife or gun, but not from the equally dangerous threats of hydrocarbons, lead, nitrous oxides, ozone or carbon monoxide in the atmosphere. There is no protection from the assaults of noise, glare and stress. So while a handrail may be provided for your safety and convenience by a considerate government, you may drown in a floodplain, suffer loss of life and property from inundation of coastal areas, from an earthquake or hurricane; the damage or loss of life could be due to criminal negligence at worst and unpardonable ignorance at best, without the protection of governmental regulation or of laws.

It clearly should be otherwise; there is a need for simple regulations, which ensure that society protects the values of natural processes and is itself protected. Conceivably such lands wherein exist these intrinsic values and constraints would provide the source of open space for metropolitan areas. If so, they would satisfy a double purpose: ensuring the operation of vital natural processes and employing lands unsuited to development in ways that would leave them unharmed by these often violent processes. Presumably, too, development would occur in areas that were intrinsically suitable, where dangers were absent and natural processes unharmed.

The formulation of these regulations requires no new science; we need move no nearer to the threshold of knowledge than the late 19th century. We can initially describe the major natural processes and their interactions and thereafter establish the degree to which these are permissive or prohibitive to certain land uses. This done, it will remain with the government and the courts to ensure our protection through the proper exercise of police power.

Before we move to this objective it is necessary to observe that there are two other views. They must be examined if only to be dismissed. The first is the economist's view of nature as a generally uniform commodity--appraised in terms of time distance, cost of land and development and allocated in terms of acres per unit of population. Nature, of course, is not uniform but varies as a function of historical geology, climate, physiography, soils, plants, animals and--consequently--intrinsic resources and land uses. Lakes, rivers, oceans and mountains are not where the economist might want them to be, but are where they are for clear and comprehensible reasons. Nature is *intrinsically* variable.

The geometric planner offers another alternative, that the city be ringed with a green circle in which green activities--agriculture, institutions and the like--are preserved or even introduced. Such greenbelts, where enforced by law, do ensure the perpetuation of open space and in the absence of an alternative they are successful--but it appears that nature outside the belt is no different from that within, that the greenbelt need not be the most suitable location for the green activities of agriculture or recreation. The ecological method would suggest that the lands reserved for open space in the metropolitan region be derived from natural-process lands, intrinsically suitable for "green" purposes: that is the place of nature in the metropolis.

A single drop of water in the uplands of a watershed may appear and reappear as cloud, precipitation, surface water in creek and river, lake and pond or groundwater; it can participate in plant and animal metabolism, transpiration, condensation, decomposition, combustion, respiration and evaporation. This same drop of water may appear in considerations of climate and microclimate, water supply, flood, drought and erosion control, industry, commerce, agriculture, forestry, recreation, scenic beauty, in cloud, snow, stream, river and sea. We conclude that nature is a single interacting system and that changes to any part will affect the operation of the whole.

If we use water as an indicator of the interaction of natural processes, we see that the forests felled in the uplands may have an identical effect upon the incidence of flood that is accomplished by filling estuarine marshes. Pollution of groundwater may affect surface water resources and vice versa; urbanization will affect the rate of runoff, erosion and sedimentation, causing water turbidity, diminution of aquatic organisms, and a reduction in natural water purification. These, in turn, will result in channel dredging costs, increased water treatment costs and, possibly, flood damages and drought costs.

So we can say that terrestrial processes require water and that freshwater processes are indissoluble from the land. It then follows that land management will affect water, water management will affect land processes. We cannot follow the path of every drop of water, but we can select certain identifiable aspects--precipitation and runoff, surface water in streams and rivers, marshes and floodplains, groundwater resources in aquifers and the most critical phase of these--aquifer recharge. We can now formulate some simple propositions. Simple they are indeed--almost to the point of idiocy--but they are novelties of high sophistication to the planning process and the bulk of local governmental agencies.

Water quality and quantity are related to both land and water management. Floods are natural phenomena and reveal cyclical frequencies; healthy water bodies reduce organic matter and this varies with seasons, turbidity, dissolved oxygen, alkalinity, temperature, and the biotic population; erosion and sedimentation are natural but are accelerated by almost all human adaptations--on a uniform soil, normally the greater the slope, the more the erosion. Groundwater and surface water are interacting--in periods of low precipitation the water in rivers and streams is usually groundwater; soils vary in their productivity for agriculture as a function of texture, organic matter, chemical composition, elevation, slope, and exposure. Marshes are flood storage areas, often aquifer recharges, the homes of wildfowl and both spawning and breeding grounds, the hinterland of a city is the source of the clean air that replaces the pollutants discharged by the city. The rural hinterland also contributes to a more temperate summer climate. Can we use this information to discriminate between lands that should remain in their natural condition, lands that are permissive to certain uses but not to others and those lands that are most tolerant to urbanization--free from danger, undamaging to other values?

But, first can we afford the indulgence of reserving natural-process lands and regulating development on them in order to capture their value? Indeed we can: land is abundant. According to the French urban geographer Jean Gottman, perhaps only 1.8% of the United States is urbanized today. (Jean Gottman, *Megalopolis*, The Twentieth Century Fund, New York, 1961, p.26.) Even within metropolitan regions, there is plenty of land. In the Philadelphia Standard Metropolitan Statistical Area, 3,500 square miles--less than 20%--is urbanized today and even should the population increase to 6,000,000, there would remain at that time 70% or 2,300 square miles of open land.

If so, wherein lies the problem? Simply in the form of growth. Urbanization proceeds by increasing the density within and extending the periphery, always at the expense of open space. As a result--unlike other facilities--open space is most abundant where people are scarcest. This growth, we have seen, is totally unresponsive to natural processes and their values. Optimally, one would wish for two systems within the metropolitan region--one the pattern of natural processes preserved in open space, the other the pattern of urban development. If these were interfused, one could satisfy the provision of open space for the population. The present method of growth continuously preempts the edge, causing the open space to recede from the population center. Geometrically, a solution is not unthinkable. If the entire area of the Philadelphia region were represented in a circle it would have a radius of 33 miles. Present urbanization can be encircled by a 15-mile radius. If all the existing and proposed urbanization for a six-million population and one acre of open space for every thirty persons is encircled, then the radius is 20 miles--only five miles more than the present.

But rather than propose a blanket standard of open space, we wish to find discrete aspects of natural processes that carry their own values and prohibitions: it is from these that open space should be selected, it is these that should provide the pattern, not only of metropolitan open space, but also the positive pattern of development.

Later on we shall see that there are consistencies in land morphology, soils, stream patterns, plant association, wildlife habitats, and even land use, and that these can well be examined through the concept of the physiographic region. It is premature to employ this concept now. It is enough for the moment to insist that nature performs work for man--in many cases this is best done in a natural condition--further that certain areas are intrinsically suitable for certain uses while others are less so. We can begin with this simple proposition. Moreover, we can codify it. If we select eight dominant aspects of natural process and rank them in an order of both value and intolerance to human use and then reverse the order, it will be seen as a gross hierarchy of urban suitability.

Natural-process Value; Degree of Intolerance	Intrinsic Suitability for Urban Use
Surface water	Flat land
Marshes	Forest, woodlands
Floodplains	Steep slopes
Aquifer recharge areas	Aquifers
Aquifers	Aquifer recharge areas
Steep slopes	Floodplains
Forests, woodlands	Marshes
Flat land	Surface water

However, there is an obvious conflict in this hierarchy. The flat land, so often selected for urbanization, is often as suitable for agriculture: this category will have to be looked at more carefully. So prime agricultural land will be identified as intolerant to urbanization and constituting a high social value--all other flat land will be assumed to have a low value in the natural-process scale and a high value for urban suitability.

Within the metropolitan region natural features will vary, but it is possible to select certain of these that exist throughout and determine the degree to which they allow or discourage contemplated land uses. While these terms are relative, optimally development should occur on valuable or perilous natural-process land only when superior values are created or compensation can be awarded.

A complete study would involve identifying natural processes that performed work for man, those which offered protection or were hostile, those which were unique or especially precious and those values which were vulnerable. In the first category fall natural water purification, atmospheric pollution dispersal, climatic amelioration, water storage, flood, drought and erosion control, topsoil accumulation, forest and wildlife inventory increase. Areas that provided protection or were dangerous would include the estuarine marshes and the floodplains, among others. The important areas of geological, ecological and historic interest would represent the next category, while beach dunes, spawning and breeding grounds and water catchment areas would be included in the vulnerable areas.

No such elaborate examination has been attempted in this study. However, eight natural processes have been identified and these have been mapped and measured. Each one has been described with an eye to permissiveness and prohibition to certain land uses. It is from this analysis that the place of nature in the metropolis will be derived.

Urban Population Expansion and the Preservation of Nature

Edmund N. Bacon

The second part of my discussion deals with country communities and with man's relationship with nature. Here, I think that there is a kind of parallel in some curious and very unfortunate ideas which produce a result exactly contrary to their supposed intent. One of these, in my opinion, is the idea of low density. In his avowed determination to relate to nature, a man rushes out into the countryside and seizes a tiny fragment of nature for himself, in the process destroying the very things he seeks, and, as one of many doing the same thing, he deprives the whole city population of the advantages of easy and pleasant access to examples of the phenomenon of nature. There is a kind of ghastly lack of awareness of what nature actually is: that it is, in fact, a phenomenon, and not an absolute commodity that can be bought and sold; that its survival depends on an interlocking series of interdependent functional systems; and that to fragment the terrain, to slash it up in pieces, and to change the grading and drainage systems upsets the ecological balance and simply destroys the product as nature.

The monumental paradox is that the stereotype which exists in most people's minds, and is enshrined in planning documents and in the law, is the one which is best calculated, when carried out on a large scale, to destroy nature--and that is the notion of the large lot. Under present zoning procedures and court decisions, the largest lot that is usually permitted to be required as a minimum under zoning is in the vicinity of, perhaps, two acres. The zoning of most of the areas around cities--into which the future population expansion must go--into two-acre lots simply assures that the natural attributes of the countryside will be destroyed and that the total area so destroyed will be many times that which would occur if the people lived on smaller lots. Thus, when viewed from a fragmented point of view, the idea of large lots seems sensible, but when viewed from a total point of view, it is the most destructive policy that could possibly occur, and the area so destroyed will be many times that which would occur if the same population were housed closer together and if some really natural areas were preserved between the more closely knit communities.

The approach here would be that the possession of nature imposes a discipline. It would impose on anybody wishing to possess nature the responsibility for possessing a large enough continuous piece of the terrain so that there is a reasonable chance for the natural processes to hold together. The natural and biological sciences could do a study to determine what the critical dimensions would be. As a rough working figure, I shall use the figure of ten acres as a minimum which would have to be under single ownership to ensure anything like the natural product. This would lead to the idea that anyone seeking to possess nature would be required under the zoning law to acquire at least ten acres as a minimum to achieve his objective and to discharge the responsibility which his objective entailed. Next, we shall introduce the concept, which, as far as I know, is totally unknown in zoning literature, of setting a minimum lot size, not a maximum lot size; therefore, if you wanted to buy a natural setting, you would be required to have a minimum of ten acres, and more than that if you wanted.

This article originally appeared in the Annals of the American Society of Political and Social Science, July 1968, and was reprinted in Land-Use Controls: A Quarterly Review, Vol. 2, No. 3 Summer 1968.

For the part of the population that did not care to undertake the responsibility of ownership of such a tract, the critical elements are the general scarcity of space --a problem which, as a nation, we have not faced--and the necessity of using space around large cities economically, of so distributing the population that the greatest number of people have the most ready access to natural areas. Here, there would be a ceiling set in the zoning ordinance on the amount of space which any family may have, recognizing that it does not choose to assume the responsibility of really owning nature, but wishes to benefit from nature which is owned by other people.

A functional analysis of the actual space needs of a family would soon reveal that the outdoor space required for the various functions of a family is very small in reality. Then this would serve as a basis for a ceiling on the amount that could be occupied by those living in a close-knit community.

The Maximum-Minimum Lot-Size Zoning Concept

This leads to the new concept of maximum-minimum lot-size zoning, and would provide the regional planner, at last, with a tool which could be used to do something about the outward march of the cities, which, up to now, has been allowed, virtually uncontrolled, to sweep all natural amenities before it and to destroy the setting and the hinterland of cities. The planning problem then becomes that of so interweaving the large-lot open areas and the close-knit residential communities that the residents of the latter have easy access to the former. The dimensioning of the residential communities--for example, planning them to be of such a size that one could walk from the center to the edge in ten minutes, or, conversely, could drive in five minutes--becomes a key planning matter. In essence, this is the texturing of human settlement in the outreach of cities.

The planning of the interaction of these two clearly different kinds of areas is deeply influenced by the nature of the topography and natural ecological development. In fairly rolling areas, it might be logical for the government to buy strips of land along the stream valleys which would protect the streams and provide public footpaths, and to strengthen the narrow strips of public ownership by areas of large-lot zoning adjacent to them which would reenforce their natural setting and provide areas for enjoyment of the residents of the close-knit communities beyond. In broad, flat areas, quite a different pattern may be logical, and the special habits and cultural traditions of each section of the country can be expressed in the regional plan.

So far, most effort dealing with the problem of urban extension has been expended, and has expired, in polemics about how bad the situation is. Almost nothing has been said or written about positive steps that could be taken to channel urban growth into more constructive forms. For that reason, I think that this concept of maximum-minimum lot-size zoning should be given careful study as to its feasibility to be carried out.

From a legal point of view, I think that the court cases which have thrown out minimum-lot zoning for large areas, say, five acres, on the ground that this is "snob zoning," designed to keep out the poor, could be seen in quite a new light if the minimum lot size is demonstratedly related to the small-lot adjacent community, and is clearly designed to carry out a major social purpose.

To make the zoning effective in actually controlling the development which takes place, the whole question of the public health and of sanitation and drainage could be brought into play. In essence, if there were a strong and enforceable state law that no house could be built on a lot of less than a given acreage unless it is connected to a public sewer system leading to a sewage-treatment plant, then the ever growing problem of the cumulative effect of septic tanks too close together would be removed, and the systematic coordination of the planning of minimum-maximum lot areas related to the construction of public water supply and sewage systems would actually control the location of the vast majority of new urban developments. The drainage systems could then be developed logically and systematically on a natural drainage basin basis--the health and sanitation aspect fitting in logically with the minimum-maximum lot-size concept. Federal assistance in the construction of the trunk sewers and sewage-disposal plants would help to supply the positive push to a rational development of the region, the prevention of stream pollution, and guidance for the outward push of cities into a countryside that would not be totally destroyed.

You will note that the objective of the city home, that of rich experience for the children, is not totally unconnected with the objective of the home on the outskirts, for, here also, most families would be reasonably close together. The form of development would not, of itself, guarantee variety of backgrounds of families in the close-knit areas, but would make interaction possible if means could be brought to bear actually to achieve integration in these areas also.

The Relationship Between Land Use and Environmental Quality: Institutions, Processes, Techniques

Individual thinkers since the days of Ezekiel and Isaiah have asserted that the despoliation of land is not only inexpedient but wrong. Society, however, has not yet affirmed their belief. I regard the present conservation movement as the embryo of such an affirmation.

Aldo Leopold

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The Relationship Between Land Use and Environmental Protection

E. J. Croke, K. G. Croke,
A. S. Kennedy, and L. J. Hoover

Introduction

In the past five years, the term "environmental protection" has been transformed from a concept existing in the minds of a select group of specialists and concerned citizens groups to a national issue of the highest priority. In response to this development, it became necessary to review the processes by which goods are produced, consumed, and ultimately disposed of in the United States, with respect to the environmental consequences of these activities.

In order to accomplish this, the federal government initiated a comprehensive series of programs. Numerous studies were conducted to identify the environmental damages resulting from industrial, commercial, residential, agricultural, and transportation activities which constitute the prime sources of pollution. Federal, state, and local legislative programs giving broad powers to regulatory and enforcement agencies were enacted, and enforcement actions have taken place at every level of government.

One of the more significant steps forward occurred when the Federal Environmental Protection Agency (EPA) was established within the executive branch of the government. Simply stated, the mandate of the EPA is to define environmental quality standards and to provide leadership and assistance to state and local governments in establishing programs designed to achieve and enforce these standards. In particular, The Clean Air Act as amended in 1970 and the Federal Water Pollution Control Act provide the EPA with the authority and responsibility to restore and maintain the quality of our air and water resources.

Under this mandate, environmental quality standards have been established, and the guidelines and framework within which state and local governments must plan and implement programs designed to achieve these standards have been developed. As part of this program, the EPA has engaged in and promoted surveillance, enforcement and monitoring activities; provided financial and technical assistance to state and local governments; and supported research, planning and technological assessment programs at the federal level.

This effort has, until now, emphasized the abatement and control of pollutant discharges through the application of appropriate control technology to individual sources of pollution. This emphasis occurred because of the acute need for prompt and effective control of existing pollution sources and the current availability, at the state and local levels, of institutions geared to the administration of traditional, technology-oriented regulatory activities.

The initial focus on source control technology represented an essential first major stage of the national environmental protection program.

Prepared by the Argonne National Laboratory Center For Environmental Studies as a Briefing Document for the Joint Meeting of the President's Water Pollution Control Advisory Board and Air Quality Advisory Board, March 27-31, 1972.

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Although the installation of air pollution emission control devices, completion of fuel and process conversion programs, construction and upgrading of waste water treatment facilities, etc., which occur as a result of this program, will have a significant effect on the control of environmental pollution; in many instances such controls may not be sufficient to achieve and maintain environmental quality standards. Even in many areas where currently available pollution control technology can temporarily achieve environmental quality standards, rapid development may render present control regulations and programs ineffective within a few years. A prime case in point is Illinois' modern Hanover sewage treatment plant, which two years ago was regarded as one of the most advanced in the nation. Explosive development of the surrounding area served by the plant has saturated its capacity, caused it to become an environmental nuisance and forced a moratorium on further sewer connections.

Since technology-oriented pollution control programs, however effective, cannot fully ensure that environmental quality standards will be achieved and maintained, it is necessary to explore and evaluate the need for the national environmental protection program to enter a second stage in which environmental protection is viewed within the broader perspective of urban and regional development. For the most part, the more sophisticated pollution control plans developed to date are dominated by traditional, technology-oriented regulatory practices and do not take account of the economic and population development trends which have led to environmental degradation. The pressures of economic growth and development, proliferation of transportation systems, increasing population densities and rapid expansion in housing developments may pose both actual and potential threats to the maintenance of environmental standards.

The real or potential environmental dangers of past and present land use decisions raise many difficult policy questions regarding the future of the environmental protection program. These include:

(1) Is an orderly process of monitoring and controlling the changes in land use and development needed to reflect the natural assimilative capacity of the land?

(2) If such a process is needed, how can environmental protection programs determine the fact that certain areas are not capable, from an environmental point of view, of tolerating certain types of development?

(3) How can such programs monitor efficient economic growth in environmentally suitable areas within the constraints imposed by the capability of pollution control technology to allow for such growth? . . .

The Impact of Land Development on Environmental Quality

The full impact of past and present land use decisions on environmental quality is still not fully understood or documented. From a preliminary examination of individual instances when past land use or developmental decisions have generated a significant degree of environmental degradation, four conclusions may be drawn:

(1) The environmental impact of land use development is pervasive in that almost all forms of economic activities--residential, industrial, transportation, recreation, etc.--have contributed to some instances of environmental degradation.

(2) The environmental impact of present economic developmental decisions will be of a prolonged nature and may be irreversible.

(3) The environmental problems posed by past land use or developmental processes are not always susceptible to solutions involving the application of a control technology.

(4) The environmental consequences of land development decisions are not fully perceived when these decisions are made.

The Pervasive Nature of Environmental Impacts Caused by Past Land Use Decisions

The extent of environmental impacts caused by past developmental decisions can be graphically illustrated by documenting several examples drawn from the area of transportation planning, industrial and residential development, and recreational and agricultural activities.

In the area of transportation planning and development, many instances of severe environmental consequences caused by the introduction of new transportation systems can be cited. For example, as of January 15, 1972, it appears that many major urban areas will be unable to attain current air quality standards for the vehicular pollutants unless current emission control technology is supplemented by transportation system controls. The urban areas which may require such environmental land use control are not limited to any specific geographical area of the United States. . . .

Increased air transportation has caused a trend toward industrial location and housing developments near major airports. Problems of air pollution, water pollution, noise nuisance, and potential accident hazard to the resident population have resulted, even though the airport was initially located in an isolated area. . . .

Urban expressways generate noise which has proved to be a serious handicap to school activities. Among the growing number of suits filed against state highway departments is an award of $165,000 to the Elizabeth, New Jersey, Board of Education for damages arising due to noise from Interstate 278.

Rapid or excessively intensive residential development is also causing environmental problems in various regions of the United States. In Fairfax County, Virginia and Du Page County, Illinois moratoria were placed on sewage connections because the capacity of local waste water treatment facilities has been saturated as a result of rapid development. In effect, these actions constitute a moratorium on land development. . . .

Failure to take account of the fact that some intensively developed areas are particularly susceptible to environmental pollution as a result of meteorological conditions, topographical features, soil structure,etc., often leads to environmental degradation. . . .

Lastly, the pursuit of recreational activities has also had adverse effects on our national forest and scenic areas. Burgeoning second-home and resort development has caused considerable alarm in states such as Vermont, Maine, Colorado, and Hawaii. These states are moving to protect their natural areas by developing strict land use regulatory programs to be administered by state agencies.

The Irreversibility of Environmental Problems Caused by Land Use Practices

We may distinguish two cases of irreversibility--physical irreversibility and socioeconomic irreversibility. Physical irreversibility implies that even if we ceased to pollute or degrade the environment, natural regeneration would not restore the resource to an acceptable or desirable quality. Such is not the case with air contaminants that would be washed out, for the most part, in a short period of time if all emissions were to stop. Water resource regeneration, however, generally will take much longer; indeed, certain lakes may become essentially irreversibly polluted. Reforestation, strip mine reclamation, and shoreline dunes regeneration are other examples where regeneration by natural processes may take many years to accomplish.

In the absence of a land management program, the use of unsuitable land disposal methods for liquid and solid wastes may result in nearly irreversible contamination of groundwater supplies and surface receiving waters. . . .

A second form of environmental irreversibility has to do with the workings of our socioeconomic system. Our large urban complexes have evolved over several decades and some have been in existence for centuries. Buildings, transportation systems, and public services are designed for long economic lifetimes. Decisions to encourage and even subsidize private automotive transport systems have evolved a certain urban form and life-style. Although strict controls on automotive emissions have been promulgated and will have a significant effect on the amount of these pollutants, the continued rise in vehicular miles in large urban areas, such as Los Angeles, may again threaten the air quality of that city regardless of the control technology employed.

The investment in new town development and urban renewal throughout the nation has been quite substantial in the past few years. The consequences of these large scale public and private investment programs are also likely to be difficult to reverse. Decisions being made now with regard to the location, type, and quantity of such housing developments may have an effect upon the localized environment within the area of these projects for long periods to come.

The interlocking urban system that has evolved because of these transportation and development decisions cannot be rearranged easily. Many years must be spent before such areas can be restored to environmental balance, if indeed this is possible.

The Capability of Pollution Control Technology to Lessen the Environmental Impact of Land Use Decisions

The effectiveness of the application of control technology to environmental problems caused by past land use decisions is often severely limited. Reference has already been made to the projected failure of automotive emission controls to attain certain air quality standards in some major American cities. Other serious pollution problems regarding the use of land have also arisen which do not seem susceptible to the application of control technology or the alteration of present techniques. For instance, although some states are currently considering restrictions on the amount of nitrogenous fertilizer that can be applied per acre, such controls may not be effective unless they are applied in conjunction with the establishment of buffer zones between agricultural areas and natural receiving waters. Buffer zoning may also be the only effective means of preventing silting and sedimentation of streams as a result of erosion due to farming, earthmoving, and strip mining activities.

In many instances, land use regulation may be the only feasible strategy of pollution control available. This is particularly the case for area-wide sources of pollution, such as agricultural activities, strip mining, and indiscriminate dumping of liquid and solid wastes on land disposal sites. . . .

Recognition of the fact that control technology alone may be insufficient to protect natural receiving waters adjacent to developing areas has resulted in such shoreline land use regulatory programs as those adopted for San Francisco Bay, Lake Tahoe, and the coastal areas of Maine, Vermont, Wisconsin, and Hawaii.

Land Development and Unknown Environmental Impacts

The long-range environmental effects of past land development decisions were not always perceived or known when development decisions were made. Even when adverse effects were perceived, they may have been discounted in the face of economic growth incentives.

Public capital expansion programs provide excellent examples of this phenomenon. Airports sited in rural areas almost inevitably cause rapid economic expansion that compounds environmental problems. Sewer facility construction encourages growth and residential development in open space and scenic areas. New or improved road systems induce congestion and sprawl and are saturated in a short time. Water treatment facilities improve riverside property and may subsequently lead to development which overloads the capacity of the treatment facilities and returns the water to its polluted state. . . .

Our economic system, in the past, has been geared to allow questionable facilities to locate and operate before all the environmental rists have been evaluated. These examples indicate a need for a unified system of projection, evaluation, and information dissemination before environmentally hazardous or degrading facilities are constructed.

Historical Perspective of Land Use Planning and Development Practices

The process by which the public effects changes in land use patterns can be thought of as a matrix of interacting institutions and techniques. The process is a complex and frequently confusing one consisting of the formulation by planning institutions of land guidance policies whose adoption and execution ultimately depend upon the diverse political, social and economic constraints affecting land use. Thus, although planning institutions and techniques cannot be considered as independently functioning systems of land use guidance, these institutions and techniques do represent a potential source of policy guidance in assessing the environmental impact of land use decisions.

Land Guidance Institutions

The public institutions most concerned with guiding land use are primarily planning agencies. . . .

The traditional concern of local (city and county) planning agencies has been with land use as exemplified by their research and plans, and the land use controls they frequently administer. Land use remains their principal concern, although many have broadened their activities to include social and environmental issues. . . .

Planning agencies at the local government level essentially consist of city, county, and combined city-county agencies. . . . Local planning agencies have traditionally been concerned largely with land use, and have assisted in administering such controls as zoning and subdivision regulation. State enabling legislation in all fifty states has delegated the powers of land use regulation to local city and/or county governments.

Planning at the metropolitan and regional level has undergone dramatic change in the last few years with the enormous increase in the number of councils of governments (COGs) governed by local elected officials, many of which replaced existing metropolitan or regional lay planning commissions. . . .

The rapid increase in the number of COGs (from 19 in 1966 to 328 in 1971) and the regional planning agencies in general is directly attributable to their favored treatment by the federal government. Starting with the initial funding authorization in the 1965 Housing Act, federal matching funds have been available to regional councils for an increasing number of programs, including planning for housing, criminal justice, and water and sewer systems.

Much of their strength derives from the Department of Housing and Urban Development requirement that there be a "certified" regional planning activity in every metropolitan area in order to qualify communities for receipt of bonus grants for water supply and sewage system construction and for open space purchase. The 1966 Demonstration Cities and Metropolitan Development Act added additional strength by empowering such agencies to review applications for federal grants from public and private bodies. Among documents requiring their review are environmental impact statements prepared in conjunction with any federal or federally-assisted project or program. As of April 1971, the federal Office of Management and Budget had designated 403 metropolitan and regional bodies, commonly called "clearinghouses," to conduct such reviews. The eventual result of this program will be to set up the machinery for an orderly review of the environmental impact of federal grant projects on a regional level.

From their initial concern with public works in the 1930s state planning agencies have also grown in numbers and have changed their activities substantially. There are now planning agencies in all 50 states, many of which perform statewide physical, social, economic, and environmental planning. Much of the impetus again comes from the federal government in the form of planning funds (since 1961) and federal program review responsibilities. A few state planning agencies continue to focus on economic development or the administration of local planning assistance funds. . . .

When located at the governor's office, state planning agencies are used as staff support to the governor in making government-wide policy decisions. There exists a general trend toward bringing state planning agencies into the central decision-making arena and out of the special purpose functions of the past. However, some states have yet to regard planning as having an important role in central policy-making. Some state planning agencies serve as mere "data-banks" or carry out other specific support functions, such as federal grantsmanship or providing planning assistance to local governments. State planning is often not supported by state legislatures, many of which are not convinced of the need for planning at the state level. . . .

Many other public bodies influence or guide land use. These include state and local highway and public works departments as well as environmental control agencies (e.g., California's pollution control districts) and special districts for transportation (e.g., Bay Area Rapid Transit District; New York's Metropolitan Transit Authority) and utilities (e.g., The Metropolitan Sanitary District of Greater Chicago). These agencies, unlike the planning agencies, have not been given direct responsibility over land use, yet their decisions have a significant and lasting influence over the pattern and character of land use. Frequently, their decisions are at odds with the objectives of the planning agencies.

Land Guidance Tools and Techniques

The system of land use guidance techniques used by planning agencies may be divided into five categories: advice, controls, inducements, development, and acquisition.

Advice is the oldest and most frequently used device. Planning agencies give advice to governmental departments and officials, to other governments, to private organizations, and to individuals. They may do this in response to requests for assistance, because of a state or federal review requirement, or at their own initiative. The most common form of planning advice is the comprehensive plan itself, which sets forth policies and guidelines for future development, usually based on a set of objectives and future projections. Such plans seldom carry any legal authority except to commit a legislative body to a general course of action and, when used effectively, to establish the framework for the laws and ordinances which control private development decisions. Many planning agencies also prepare capital improvement programs which set forth the community's intended capital expenses over the next 5 to 7 years.

Controls, especially land use controls, have been the major tools used by local governments to implement their plans. Such controls include zoning, which separates land use activities into districts and establishes density, height, bulk, and related provisions; subdivision regulations, which set standards for land conversion and new development; and the less commonly used official map, which delineates and reserves sites for future parks, schools, streets, and other public uses. Related to these are housing and building codes which set standards for new building construction and dwelling maintenance. Although zoning has traditionally been oriented to the separation of different land use activities, it may take other forms, such as: the setting of performance standards under which zoning districts are established, based upon the allowable external nuisance impact of an operation, the regulation of the location of special sources of pollution such as power plants, or the establishment of special buffer zones to protect areas from environmental contamination.

Inducements or incentives have been used to attract particular land uses and development which contribute to certain objectives. Land use programs, for example, have begun to offer incentives through (a) planned unit development provisions which encourage improved subdivision design and greater retention of open spaces, and (b) density bonuses for buildings which provide such amenities as open plazas, direct access to public transportation, and enclosed walkways.

Such other devices as low-interest loans, tax exemptions, aids in land assembly, and direct subsidy payments have been used to attract activities deemed especially desirable.

Public land development or public works had a great effect on shaping and directing urban growth through construction of transportation systems, public institutions (e.g., state colleges and hospitals), and utilities. In the past, public works have usually been constructed in response to development or market pressures; recent years have brought an increasing awareness of the impact of public investment decision on establishing an infrastructure for private decisions. The role of a new highway or a sewer system in influencing development direction has clearly been recognized, although not fully utilized.

Finally, acquisition involves the direct purchase of lands for the purpose of conserving their present recreational characteristics. The purchase of land for forest preserves, parks or green belts would fall under this category.

The Effectiveness of the Land-Guidance System

Overall, the land-guidance "system" does not operate very systematically. The failings of the system--or nonsystem--have been well documented. The more fundamental problems with the system include the following:

(1) A far more extensive history of applying controls than using preventive or incentive devices;

(2) The balkanization of guidance techniques among numerous local governments (balkanization presents a special problem since environmental issues almost always are regional in scale);

(3) The lack of effective techniques to resolve competition among jurisdictions for high tax ratables--usually industry--which underlies all other land use decisions;

(4) The fact that most decisions remain private, reflecting the feeling that land is a private commodity rather than a community resource;

(5) The weakness of enforcement power and its susceptibility to political and economic pressures;

(6) The lack of relation between--and occassional conflict among--the various techniques, and their sponsoring governments;

(7) The frequent lack of relation of the system to a generally-accepted plan.

The lack of a single institution with total responsibility for guiding or directing land use, and the occasional lack of cohesiveness among the techniques, does not mean that the system itself is ineffectual or a failure; it simply means that it is not "comprehensive." It is not surprising that the system is not systematic or complete, given our attitudes concerning land as a private commodity and our desire to interfere in land use decision-making as little as possible in meeting public interest objectives. The essential point, however, is not that the system is less than perfect, but that the system can and does achieve limited purpose objectives. For example, techniques and institutions are available to assure the provision of adequate streets in subdivisions, to separate so-called "incompatible" uses, to guarantee that new homes are not built in the right-of-way of a proposed road extension, and so on. By the same token, there are many land use objectives for which there exist no adequate institutions or techniques.

Introducing Environmental Objectives into the Land-Guidance System

When asking whether environmental objectives can become an integral part of the present land-guidance system, the answer, as usual, depends on the particular objective. If, for example, the objective is to guarantee that all future development in a metropolitan area is located so as to achieve air quality standards, then the answer would have to be no. Metropolitan and regional planning agencies simply don't have the expertise or resources to make this kind of guarantee, and there is no way of assuring that each of the individual jurisdictions which make up the metropolitan area would voluntarily submit to the fulfillment of this metropolitan-wide objective.

If different environmental objectives are advanced, then the system could respond by internalizing those objectives with little or no difficulty. And, in fact, discussion need not be hypothetical, since environmental objectives are already incorporated into many of the techniques now in use, including:

(1) Performance standards have been designed to classify industries by their environmental impact, i.e., to separate the heavy polluters from cleaner industry and other residential and commercial activities.

(2) In recent years, flood-plain zoning has been used both to protect life and property from the ravages of floods and to maintain the carrying capacity of streams in periods of high water flow to minimize downstream damage. The Federal Flood Insurance Program has provided an incentive for the use of this type of zoning.

(3) Most subdivision regulations which permit septic tank sewage disposal require percolation tests to determine the ability of the soil to handle on-site disposal; in fact, many subdivision regulations prohibit on-site disposal entirely.

(4) Hillside development or grading regulations have been used to preserve the integrity of slopes and reduce erosion and sedimentation.

(5) The purchasing of easements or development rights has been used to preserve open space and other scenic areas.

(6) Agricultural zoning and preferential assessment of farm land have helped to preserve prime agricultural land, although these techniques have not proven to be as effective in practice as might have been expected.

(7) Special preservation districts in zoning ordinances have been designated as conservation zones to protect historically or architecturally significant areas.

Thus, while the existing system has some significant weaknesses, there does exist a broad array of techniques and institutions with the experience and potential capacity to aid in dealing with environmental questions.

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Historical Perspective of Environmental Control Programs

The preceding chapter presented a brief historical perspective of urban and regional planning in terms of the feasibility of integrating environmental protection considerations into the present land use planning process. This chapter is concerned with the other side of the question, in that it provides a historical perspective of environmental control programs and addresses the question of whether land use guidance and control can be integrated into the traditional environmental protection process.

The evolution of the present environmental control program can be described by the history of enabling legislation which authorized these programs, the creation of institutions to execute the provisions of this legislation and the process by which these institutions created environmental control procedures. Since the problems encountered in establishing air quality, water quality and solid waste disposal programs differ significantly, the legislative history, institutional response and planning procedures have also varied. The nature of these legislative, institutional and planning programs will, to a large degree, determine the ease with which environmental protection agencies can incorporate land use planning and control objectives into their present programs.

Environmental Protection Legislation

The development of environmental protection and enhancement measures in the United

States has been determined to a considerable extent by federal legislation. This has been determined to a considerable extent by federal legislation. This has encompassed the whole range of environmental insults from air pollutants to solid waste, but has, for the most part, been formulated as an array of single-purpose legislative instruments, each directed toward some specific pollution problem.

Water Quality Legislation--The modern legislative approach to the problems of environment began with the Water Pollution Control Act of 1948. With the amendment of this Act in 1956, an enforcement procedure, consisting of a conference hearing/court action process, was provided for water pollution abatement. Financial aid in the form of grants and loans were also provided under the Act. The federal Water Pollution Control Act of 1961 strengthened federal enforcement procedures.

The Water Quality Act of 1965 required the states to establish and submit water quality standards for all interstate waters and a plan for the rapid achievement of the standards. These standards became the basis for most actions under the federal Water Pollution Control Act, including planning activities, the awarding of construction grants and enforcement practices.

The 1966 Clean Water Restoration Act provided for expanded research in advanced waste treatment and provided a grant system to support the establishment and maintenance of river basin planning based on water quality standards. The Act also vastly increased authorized expenditures for municipal waste treatment works construction.

In late 1970, the President announced a new program to control water pollution through the permit authority of the Refuse Act of 1899. The Refuse Act outlaws discharges and deposits into navigable waters without a permit from the Secretary of the Army. The program makes a permit mandatory for all industrial discharges into navigable waters of the United States. Violators of standards--including standards imposed by the EPA when federal-state or state standards do not apply or are clearly deficient--are ineligible for permits and liable to enforcement proceedings. The Water Quality Improvement Act of 1970 further provides that any federally regulated activity must have state certification that it will not violate water quality standards.

Air Quality Legislation--Federal legislation related to air pollution began in July 1955 when Congress authorized a federal program of research on air pollution and technical assistance to state and local governments. The Clean Air Act of 1963 and the Motor Vehicle Act of 1965, augmented by the Air Quality Act of 1967 and culminating in the Clean Air Act Amendments of 1970, represent the most significant federal legislation regarding air quality. The 1970 Amendments, as the strongest air pollution control legislation, authorize the regulation of both mobile and stationary sources of pollution. The most important sections of these programs deal with establishing national air quality standards, describing a framework for the states to meet these standards, and improving procedures for federal enforcement. The EPA has thus far set national air quality standards for particulate matter, sulfur oxides, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen dioxide. Federal Guidelines have been published by the EPA requiring that states submit implementation plans for the attainment and maintenance of these standards.

The 1970 Amendments also provide for more effective federal enforcement by providing the EPA authority to issue compliance orders to any person violating applicable implementation plans or to bring civil suit against any person in violation of implementation plans, and authorize citizen suits to enforce the provisions of the Clean Air Amendments.

The Clean Air Amendments are an example of a recent shift in the burden of proof in pollution control. When the EPA now specifies that an air pollutant is a health hazard, industry must either comply with the emission standard or prove that the health hazard does not exist.

Solid Waste Disposal Legislation--The Solid Waste Disposal Act of 1965, the first legislation aimed at solid waste management, is directed primarily at the loss of natural resources which solid waste represents. This Act authorized a research and development program with respect to solid waste to promote the demonstration, construction, and application of solid waste management and resource recovery systems. In addition, the Act provides financial and technical assistance to states and local governments and interstate agencies in the planning and development of resource recovery and solid waste disposal programs, and promotes a national research and development program for improved solid waste management programs.

The Resource Recovery Act of 1970 put a new emphasis on recycling and reusing waste materials by authorizing funds for demonstration grants for recycling systems and for studies of methods to encourage resource recovery. This Act also requires the EPA to publish guidelines for construction and operation of solid waste disposal systems.

In a further move to institutionalize the concern for the protection of the environment, the Congress passed the National Environmental Policy Act of 1969 (NEPA) establishing a national policy for the environment and providing for the Council on Environmental Quality. In recognizing the effect of man's activities on the environment, NEPA laid down the environmental impact statement requirements for federal agencies which propose to undertake activities that are likely to affect environmental quality.

Environmental Protection Institutions[1]

The recent environmental protection legislation has required the organization or reorganization of environmental programs at the federal, state and local levels in order to cope with the increased regulatory requirements of these legislative programs. An interacting set of federal, state and local environmental institutions has been established as a consequence of the reorganizations.

Federal Activities--Pursuant to Reorganization Plan 3 of 1970, the Environmental Protection Agency (EPA) was established on December 2, 1970. The EPA was created to permit coordinated and effective government action to insure the protection of the environment. EPA's mission is to define, achieve, and maintain environmental quality by abating and controlling pollution from point sources by utilizing a wide range of intervention strategies. . . .The reorganization consolidated into one agency the federal programs dealing with air pollution, water pollution, solid waste disposal, pesticide regulation and environmental radiation. . . .

Although the Council on Environmental Quality (CEQ) and the EPA work closely, their responsibilities differ significantly. The CEQ, as a staff agency in the Executive Office of the President, provides policy advice, and reviews and comments on the environmental impact control activities of federal agencies. The concern of CEQ is with the broad spectrum of environmental matters, while the EPA is a line agency with responsibility to administer and conduct federal pollution control programs.

Local and State Environmental Protection Agencies--This discussion focuses on state rather than local activities because federal legislation has put more and more responsibility at the state level. In the past, environmental programs in most states were fragmented or scattered throughout many state agencies, boards and commissions. In many cases, air and water pollution control programs were lodged in a state health department. Water pollution control programs were often incorporated into water resource management or public water supply programs. Pesticide regulation was frequently under the health department or the agriculture department; solid waste management was frequently a responsibility of the health department.

Some states have reorganized to cope with the broad scope of environmental issues. New York, Washington, and Illinois enacted legislation which consolidates pollution control programs and streamlines pollution control authority. . . .

The performance of various states in regard to elements of air quality programs are shown in the following table. The elements listed refer to requirements of state implementation plans as specified in the Clean Air Amendments.

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[1] This section summarizes discussions contained in the CEQ 2nd Annual Report, Chapters 2 and 3.

State Air Quality Program Elements

Legislative Authority	States with Authority	States without Authority
1. Adopt emission standards and promulgate other regulations	54	0
2. Require information on processes and potential emissions from sources of air pollution	39	15
3. Issue permits for construction of new sources of air pollution	38	16
4. Inspect facilities causing pollution	52	2
5. Require emission information from polluters and make it available to public	20	34
6. Require monitoring of emmission by polluters	13	41
7. Issue and enforce compliance orders	51	3
8. Enjoin standards violators	52	2
9. Take special, prompt action in case of air pollution emergencies	44	10
10. Regulate land use and transportation to meet air quality standards	5	49
11. Inspect automotive pollution control devices	16	38

Source: EPA, Office of Air Programs.

The status of development of state water quality programs in summarized in the following table:

State Water Quality Program Elements

Program Element	No. of States
1. Water Quality Standards	
Interstate (full federal approval with antidegradation)	46
Interstate (full federal approval without antidegradation)	1
Interstate (federal approval with exceptions with antidegradation)	4
Interstate (federal approval with exceptions without antidegradation)	3
2. Planning (based on water quality standards)	23
3. Permit System	
Municipal	46
Industrial	47
4. State Matching Grants	34
5. Routine Treatment Plant Inspection	46
6. State Monitoring System	49

Source: EPA, Office of Water Programs.

The "permit system" in the preceding table refers to the existence of enabling legislation to grant permits for discharges. "State Matching" refers to the availability of state funds to assist municipalities in building sewage treatment facilities. "Treatment Plant Inspection" refers to surveillance of the operation and maintenance of facilities at least once a year.

Solid waste management practices are also becoming increasingly regulated and less fragmented. As a result of the Solid Waste Disposal Act, as amended, statewide and regionwide solid waste management plans are being formulated.

Aside from these reorganizations and activities, many states have introduced innovation by providing new approaches to citizen involvement, waste management and its financing, pollution charges, and applications of new technologies. In addition, some states have increased control over types of land use in order to protect important geographic areas, such as wetlands, from environmental degradation, to restrict potentially harmful development, and facilitate desired developments. It may be noted that only five states have authority to regulate land use to meet air quality standards and only twenty-three states have initiated comprehensive planning programs based on water quality standards.

Environmental Protection Planning Procedures

The process by which environmental control programs are being established by environmental protection agencies is becoming more and more associated with the creation of comprehensive "implementation plans" usually developed by state and local governments and reviewed by federal agencies. (This trend reflects the growing recognition that environmental control programs must have clearly defined objectives and explicitly designate the legislation, administration, and resources required to carry out these programs.)

Air Quality Implementation Planning--The air quality implementation planning process typically involves a systems analysis approach to air resource management. The nature of the air pollution problem is first determined by extensive monitoring and sampling of air quality. The comparison of observed air quality levels with National Ambient Air Quality Standards defines the magnitude of the problem. These observed air quality levels are the result of the stationary and mobile source emissions of the region under various local meteorological and topographic conditions.

Mathematical models, such as atmospheric dispersion models, are then employed to evaluate alternative emission controls and to select a set of control regulations which both achieve and maintain the National Ambient Air Quality Standards. These emission control regulations define the emissions of a given pollutant permitted from a particular source type; for instance, different particulate emission control regulations may be designed for fuel combustion sources, process sources and solid waste incineration systems. In developing control regulations, consideration must be given to pollution control technology, fuel resources, and the economics of pollution control. Additional consideration must be given to the impact of growth on achieving and maintaining National Ambient Air Quality Standards. Besides emission controls, land use and transportation controls may also be instituted as part of the array of control regulations.

In addition to an evaluation of control regulations, the plan typically contains the following elements: air quality and emission data, legal enabling authority, compliance schedules for emission sources, emergency episode plans, air quality surveillance network description, permit system description, intergovernmental cooperation between adjoining states and the state and local agencies, and, lastly, the fiscal and manpower resources required to implement the program.

To assist in implementation planning, a comprehensive set of analytic tools has been developed. These tools include Rapid Survey Emission Inventory techniques for obtaining regionwide emission inventories; atmospheric dispersion models for estimating long-term and short-term air quality levels; growth trend projection models for determining the impact of economic development on emissions and air quality; transportation models from which mobile emission inventories can be generated; and, finally, system management techniques for determining the manpower and fiscal resources required to implement the plan.

Water Quality Planning Procedures--A similar unified planning requirements approach is developing in regard to water pollution programs through the EPA Waste Water Treatment Works Construction Grant Program and the HUD Water and Sewer Facilities Grant Program. The primary emphasis of these programs and the basis and rationale for all of the water pollution control activities which take place under their auspices is the attainment of established water quality standards. To promote the achievement of this key objective, planning guidelines have been published which describe the basic considerations to be addressed in meeting the EPA and HUD requirements. Grants for a water pollution control project shall not be made unless the project is an integral part of an effective basin and metropolitan or regional water pollution control plan.

The pollution abatement plan must take into account anticipated growth of population and economic activity; present and future use and value of the waters within the planning area for water supplies, propagation of fish and wildlife, recreation, agriculture, industrial, and other uses; adequacy of the waste collection system in the planning area; etc. The major objective is to establish a systematic water quality management planning procedure which includes land and water planning as well as the organizational and financial arrangements for executing the plan.

An array of analytic techniques and data is necessary in developing these implementation plans. Central to water quality management is data on water flows, pollutant discharges, and data required for forecasting future conditions and in-stream water quality. Water quality and treatment cost modeling is also required. In addition, demographic and economic development projections are required in order to determine the need for and scale of new waste water treatment facilities.

Solid Waste Disposal Planning--As a result of the Solid Waste Disposal Act of 1965 and the Resource Recovery Act of 1970, a comprehensive solid waste management planning process is developing. State solid waste management plans, funded under the Solid Waste Disposal Act, must include an inventory of waste disposal systems and a survey of problems and practices which can be used as a data base for planning. Under the provisions of the Resource Recovery Act, state solid waste management plans must include, wherever possible, provisions for recovery and recycling of solid wastes. . . .

Alternative Institutional Arrangements To Combine Land Use Planning with Environmental Control

The previous chapters have outlined the history and procedures of land use planning and environmental control programs. To a considerable extent, the development of these programs at all levels of government has been distinct and separate. Recently, however, two types of institutional arrangements have been employed which seek, in the first case, to integrate land use planning and environmental control into one agency and, in the second case, to bring together opposing environmental and developmental viewpoints into an adversary-type confrontation to resolve environmental-land use issues. Since both methods of resolving such issues are still somewhat rare in practice, the evaluation of the effectiveness of these alternative arrangements is still difficult.

New Institutions Which Combine Environmental Protection and Land Use Management

In recent years, some states have given themselves new powers and have created new regional bodies which combine the interests and techniques of land use planning and environmental concerns. Some of these were significant modifications of existing powers and institutions, while others have been entirely new creations designed to respond directly and uniquely to the issues surrounding the relationships betwen environmental quality and land use. In general, these new institutions have different structures and functions; they respond to different and occasionally unique issues, and, in some cases, they have had little opportunity to prove their success or failure. . . .

These institutions are not yet numerous, but they exemplify the potential effectiveness of this approach when used in conjunction with more traditional technological pollution controls.

Hawaii: Statewide Zoning to Balance Conservation and Development Objectives--Hawaii's 1961 Land Use Law was a bold attempt at accommodating a rapid rate of development while maintaining the unique natural beauty of the islands. The law created the Land Use Commission and charged it with dividing the entire state into four districts: conservation, agricultural, rural, and urban. . . .

Maine: A State's Response to Critical Environmental and Land Use Issues--Recognizing both the inadequacy of local land use regulations to guide development and the state's interest in certain critical areas, the state responded with several measures, including the Site Location Law and Coastal Conveyance of Petroleum Law. Under such Acts, the Environmental Improvement Commission may exercise the police power of the state to control the location of those developments substantially affecting local environment in order to ensure that such developments will be located in a manner which will have the minimal adverse effect impact on the natural environment of their surroundings. A development must meet four loosely-defined criteria related to pollutant control standards, traffic facilities, compatability with natural environment and soil suitability. . . .

Vermont Environmental Control Law--The Vermont Legislature saw that the combination of two interstate highways and a sharp increase in the number of second homes and ski resorts were certain to undo the state's rural character and its environmental heritage. To meet that threat, state officials in 1970 adopted the Environmental Control Law, which created an Environmental Board and seven Regional Commissions to see to it that most developments meet ten general environmental standards. . . .

Tahoe Regional Planning Agency--Created in 1969 under a joint compact between California and Nevada and ratified by Congress, the Tahoe Regional Planning Agency is required not only to provide for orderly development in the Lake Tahoe Basin, but also to preserve the Basin's environment.

The compact calls for a plan to be enforced by minimum standards incorporated into 19 ordinances, including land use, subdivisions, grading, shoreline and tree cutting. . . . The standards are binding on the five counties and one city in the Basin.

San Francisco Bay Conservation and Development Commission--In 1965, the California Legislature recognized that if the many local governments surrounding San Francisco Bay continued to permit shoreline developments without regard for the Bay as a whole, the Bay would be ruined. As a result, the Bay Conservation and Development Commission was formed and was given authority to grant or withhold approval of shoreline development proposals on the basis of health, safety and welfare of the public in the region and of a plan which it was instructed to complete by 1969.

Hackensack Meadowlands Development Commission--The State of New Jersey in 1969 established the Hackensack Meadowlands Development Commission with jurisdiction over the 21,000 acres of largely undeveloped wetlands across the Hudson River from Manhattan. Although local governments can review the work and decisions of the Commission, it has final authority over planning and land use control over the region. In addition, the Commission can issue bonds, levy assessments, collect fees, buy land, and exercise Eminent Domain. It is authorized to use these instruments in furthering sound development and protecting the region from air and water pollution.

Metropolitan Council of the Twin Cities--Recycled sewage in a substantial portion of the wells, with other deficiencies, compelled the Minnesota Legislature in 1967 to transform a routine regional planning commission into the Metropolitan Council of the Twin Cities area, for its time the boldest experiment in metropolitan planning and development in the nation. The council's metropolitan perspective is made specific in its plan, the Development Guide, which is binding upon various agencies required to submit their plans to the Council and is advisory to local governments. . . .

Although several public work systems--highways, airports, transit, and housing--remained outside of the Council's direct authority, its responsibility for planning and development of the metropolitan sewer and park systems does give it an important influence over regional land use issues. . . .

In 1971, the Legislature passed a law intended to relieve fiscal disparities in the region by requiring that each local government therein must contribute 40% of the net growth of commercial and industrial property tax valuations to the Council for redistribution to various local governmental units according to population and need. Fiscal measures such as this, similar in intent to the one in the Hackensack Meadowlands, are essential if regional resources are to be used effectively to resolve regional problems.

Separate Environmental and Development Agencies: An Alternative to Functional Integration

In theory and practice, there is an alternative organizational approach to addressing the relationship between planning effectively for land use development and for environmental quality, which avoids the integration of these historically distinct activities. The governing body at the local, regional, state and federal levels could create two governmental units--one to represent orderly and efficient development, and another improvement in the quality of the environment. In practice, a department like Planning, or Planning and Economic Development, or Economic Development, would espouse the goals, principles, standards, and procedures for the best kind of land use and economic development. And a governmental unit such as an Environmental Protection Agency, Department of Conservation and Natural Resources, or Conservation Commission would be an advocate for protecting the ecological/ environmental system.

The premise behind this organizational form is that the relationship between orderly development and environment quality can best be understood and dealt with by building into the government system a strong proponent for conservation and another for development. Then the elected public officials can take from both of their strategies to mold the best public policy bearing on that relationship. This adversary technique, of course, has been the central rationale and means for obtaining justice in our court system. . . .

The Need for Analytical Tools To Evaluate the Relationship Between Land Use and Environmental Quality

The need for a better understanding of the relationship between land use and environmental quality is reflected in the legislative and administrative program of land use guidance and environmental protection described in the preceding chapter. The basic premise which underlies such programs is that an institutional framework is necessary to allocate or regulate the use of land, beyond the present land market mechanisms, in order to avoid undesirable environmental impacts.

Ideally, the policies adopted by such institutions would be based on an extensive body of knowledge regarding the nature of these impacts and the alternative methods of controlling environmental damage due to present land use practices. In point of fact, this relationship is not, at present, well understood. Analytical and planning tools have, however, been developed which can be used to assess certain land use policy options and evaluate some of the aspects of the land use-environmental quality relationship. . . .

Land Use and Environmental Quality: The Federal Role

In addition to its traditional role in the management of public lands, the federal government currently engages in a broad range of land use-oriented activities conducted by a diversity of federal agencies. With the passage of the National Environmental Policy Act and the creation of the Environmental Protection Agency, the stage has been set for the integration of land use regulation and environmental protection. Current trends in national policy with regard to growth, land use and the environment enhance the likelihood that such a program will develop.

The Role of the Federal Government in Land Development, Regulation and Utilization

A number of federal agencies are currently engaged in activities which, in one way or another have an impact on land development and utilization, though not necessarily in the context of environmental protection or natural resource conservation. It is convenient to categorize these agencies in terms of whether their activities involve dealing with land as a natural resource, a location of functional activities, or a medium for the disposal of waste.

Agencies which have the responsibility of monitoring the use of land as a resource are primarily concerned with its capacity to supply various natural resources or to support different forms of economic activity. These agencies view land in terms of such characteristics as its mineral resources, soil structure, agricultural potential, forestation, natural scenic value, historical significance and open space capacity.

On the other hand, those agencies which consider land as a site of some functional activity are more concerned with the actual or potential activities which may take place on the land. This perspective is reflected in any federal regulation or agency which is concerned with recreational, residential, commercial, industrial, agricultural, transportation, utility or public service activities. (Note that these activity classifications are based on demographic-economic characteristics. No environmentally-oriented land use taxonomic system yet exists.)

Agencies which view land as a medium for the disposal of waste focus on its natural capacity to assimilate the various forms of waste which are generated as a byproduct of the economic activities which take place on the land. These include such considerations as air pollution fallout, contamination of natural receiving waters due to surface runoff, pollution of ground water resources as a result of land disposal practices, acid mine drainage, etc.

Other than the EPA, the key federal agencies which currently have responsibilities in one or more of these areas include the departments of Commerce, Defense, Interior, Agriculture, HEW, HUD and Transportation, as well as the Atomic Energy Commission, the Federal Power Commission, and the Office of Economic Opportunity.

Since the alternative ways of considering land are closely related, it is natural that in many cases, the same agencies play a significant role in all three of the categories suggested above.

As a result of the National Environmental Policy Act (NEPA), all of these agencies are now required to assess the environmental impact of their activities. To this extent, land use management and environmental protection have been legally, if not organizationally, integrated at the federal level. . . .

Federal Authority To Establish Environmental Land Use Controls

Although EPA now has the legal authority to establish land use controls, this authority is at present limited, indirect, and in some areas, implicit rather than explicitly defined. This is attributable, in part, to the fact that land use has traditionally been viewed in the context of natural resource management, regional economic development or social welfare planning. Thus EPA currently shares the responsibility for land use planning and management with a number of other federal agencies having widely divergent missions. Foremost among these are the departments of Interior, Agriculture, Transportation and Housing and Urban Development.

The statutory authority for EPA to utilize land use as a pollution control mode is, at present, defined in terms of a number of enabling instruments which focus on specific elements of the National environmental protection program. These are summarized below:

Water Pollution Control--Section 18 CFR 601, 32-33, which derive their authority from Sections 8 and 22 of the Federal Water Pollution Control Act, as amended, prohibit EPA from making a construction grant unless a project is included in an effective current basin-wide plan for pollution abatement consistent with applicable water quality standards. The Office of Water Programs has promulgated Guidelines for Water Quality Management Planning, which define an acceptable plan. The Guidelines specifically require, in several sections, the employment of land use analysis as a tool of management planning and encourage the utilization of land use control devices as one of several methods of water quality management.

The Refuse Act permit program also has potential for the control of land use. Where a permit application is for an existing discharge, the impact of the action may affect only water quality. However, where the application is for a new discharge, action on the permit has a definite impact on land use because it approves, alters or disapproves location of an industrial discharge. Disapproval may often discourage industry (unless 100% treatment in envisioned) from locating in a particular area.

A number of bills that are intended to provide additional statutory authority for the control of water pollution are now before the Congress. . . .

Air Pollution Control--Section 110 of the Clean Air Act specifies a number of factors the Administrator of the EPA must consider before approving an implementation plan. Two of these are:

(1) whether the plan includes land use and transportation controls as may be necessary, and (2) whether it includes a procedure for the review of the location of certain types of stationary sources of pollution.

Solid Waste Management--The EPA authority to regulate or promote land use planning as a solid waste management strategy is limited to federal facilities and to contingency agreements exacted through federal grant programs. Executive Order 11514 requires environmental impact statements on proposed federal activities accompanied by provision for public information, hearings, etc. This order allows EPA to control waste management activities and systems, prior to their establishment, at federal installations. Waste management requirements at federal facilities are also governed by Executive Order 11507; however, EPA's extramural responsibility in this regard consists mainly of providing technical assistance where requested.

Other EPA solid waste management programs related to land use controls are authorized under the Solid Waste Disposal Act of 1965 and the Resource Recovery Act of 1970. Planning and demonstration grants are provided only if recipients agree to carry out certain commitments such as abandoning open burning and dumping, having an existing comprehensive solid waste plan (demonstration criteria), or accepting a commitment to implement a solid waste planning program (planning grant criteria). EPA has no power to close open dumps, override local zoning, or establish solid waste facilities where local communities fail to do so.

Pesticide Control--The Federal Insecticide, Fungicide and Rodenticide Act of 1947, as amended, conveys no indirect statutory jurisdiction for environmental land use regulation. It focuses on testing and labeling of pesticides. The Federal Environmental Pesticide Control Act of 1971 makes the label directions binding and enforceable.

Radiation Program--The current EPA legal mandate for utilization of land use controls is very indirect. The Office of Radiation has authority (Section 274h of the Atomic Energy Act of 1954) to determine standards for atmospheric radiation concentrations beyond the boundaries of AEC licensed nuclear facilities. On that basis, AEC defines facility characteristics and specifications to achieve the results desired by EPA, as well as to substantially preclude nuclear accidents. Under this arrangement, EPA could specify proper zoning of the area around a facility as one of the design conditions for a nuclear power plant, nuclear fuel fabrication plants, nuclear fuel reprocessing plants and radioactive waste disposal site. However, direct authority (10 CFR 100) for establishing site criteria remains a function of the AEC.

Noise Program--The general provisions of the NEPA, Section 402C of the Clean Air Act, as amended, requires all federal agencies to consult with EPA regarding any proposed programs or activities which may create an environmental problem. This provision can be interpreted to include noise nuisances. Since the activities of other agencies, particularly DOT, HUD, and Department of the Interior, frequently involve land use oriented programs, EPA therefore now has, at least in principle, indirect responsibilities with regard to the control of noise sources through land guidance programs. . . .

The Organization of Present EPA Land Use Programs--The EPA thus has a limited mandate to incorporate land use management into its environmental protection activities. Responsibility for this mode of pollution control has thus far been dispersed throughout its various media and categorical programs or treated within the context of EPA relationships with other federal agencies. The dispersed and, as yet, limited use made by EPA of land management as a pollution control mode reflects the somewhat disaggregated character of its statutory authority.

The Office of Water Programs sponsors research relating land use and water quality. Since it evaluates basin and regional water quality management plans, the Office of Water Programs maintains a direct relationship with the Department of HUD with which it shares responsibility for the disbursement of federal waste water facility construction grant funds. This relationship represents the first, and as yet the only, formal channel of communication, other than the A-95 review process, between the agency responsible for the national environmental protection program and local and regional planning agencies. This joint EPA-HUD activity represents the nearest approach to date to the realization of a land use oriented interagency environmental protection program.

The EPA Office of Air Programs currently conducts and sponsors a number of research and planning projects which are directly or indirectly oriented toward land use planning and control. These include the development of traffic control strategies for six major cities which will be unable to meet carbon monoxide standards, the New Jersey Hackensack Meadowlands land use planning project, and the Argonne National Laboratory air pollution land use planning technique development program. The Office of Air Programs also provides technical assistance and advice relating to such land use oriented activities as the impact of chemical spraying on agricultural land management and the feasibility of open burning as a tool for forest management.

The Office of Solid Waste Management Programs administers demonstration grant programs which are concerned with the use of land fill for halting erosion, reclaiming strip mines and wetlands. This office provides regional and interstate solid waste planning grants and promotes programs such as Mission 5000, which aims to eliminate and/or convert to sanitary landfills a total of 5000 of the more than 15,000 open dumps in the U.S. during the period FY 1971 to FY 1972.

The Office of Pesticide Programs has no activity studying or involving land use controls.

The Office of Radiation Programs reviews applications to the AEC for the construction of nuclear facilities to insure that these facilities will not violate atmospheric radiation standards. Although in the past the EPA reviewers have generally recommended design modification rather than expansion of the land buffer, the latter approach is a potential option.

The EPA Office of Federal Activities is currently investigating a wide variety of land management practices at federal installations and on public lands. It has reviewed environmental impact statements for Department of Transportation highway projects, nuclear power plant sites, Corps of Engineers dredging and fill permits, and HUD new community proposals.

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Trends in National Policy with Regard To Growth, Land Use and the Environment

Alternative Institutional and Organizational Systems for Environmental Land Use Planning and Management

The national policy legislation described in the preceding section could result in the creation of new governmental institutions, but it is equally possible that the integration of land use planning and environmental protection might be realized through alterations in present jurisdictional responsibilities among existing Federal, State, regional, and local agencies. The following discussion suggests some of the possibilities.

Centralized Federal Response

The relationships between equivalent agencies in Federal, State, and local systems of government have generally been fostered through a combination of: (1) enabling legislation which defines the jurisdictional authority of related agencies at different levels of government, and (2) Federal and State grants-in-aid programs designed to subsidize socially desirable courses of action.

Such systems of complementary agencies, which discharge similar responsibilities at different levels of government, have proliferated in recent years. It is characteristic of these systems that a single Federal agency at the top of the hierarchy will promote research, formulate Federal regulations and disburse Federal grant funds to agencies at a lower level of government, for example, State or regional regulatory or planning agencies. Corresponding State agencies implement programs, develop State regulations and disburse state funds to regional and municipal agencies, etc. Such a relationship of Federal, State, and local interactions has developed in the National environmental protection program, where Federal EPA grants for implementation planning, State and local control agency development, and waste treatment facility construction have provided an incentive for the development of desirable pollution control programs.

This general pattern of a hierarchy of mission-oriented complementary agencies is repeated in many other departments of government, and it suggests one possible approach to the problem of integrating land use planning with environmental protection. That is, a single Federal agency could be assigned the responsibility and jurisdictional authority to develop and promote environmental land use regulatory activities at the State, regional and local levels. The states would be required to develop appropriate environmentally-oriented land use implementation plans, supported by adequate legal authority and administered by suitably equipped State and local agencies. A Federal grant program to induce appropriate planning activities and partially subsidize control programs could be established and administered by the designated Federal agency.

Decentralized Federal Response

It does not follow that the approach described above is the only, or even the most desirable, means of achieving environmentally-oriented land use regulation at the State and local levels. The joint EPA-HUD wastewater facility construction grant program suggests a somewhat less centralized alternative. Through the medium of the jointly administered grant program, a formal linkage between the EPA and its complementary agencies at lower levels of government and the HUD has been established. (Wastewater facility grant applications from municipalities must be integrated within the context of basin and regional water quality management plans certified by both the State environmental protection agencies, which are complementary to the EPA, and by HUD--designated Area Planning Offices--the latter are the regional planning agencies which are complementary to HUD.) Detailed planning guidelines were jointly prepared by EPA and HUD, and some of the analytical techniques required are supplied by EPA.

This approach could serve as a model for a more broadly based land use-oriented environmental protection program in which similar liaisons are established between the EPA and its complementary Federal agencies. For example, an analogous arrangement between EPA and the Federal Department of Transportation (DOT) might be established for the disbursement of Federal transportation system construction funds. Not only would Federal construction grants be contingent on the preparation of environmental impact statements as is now the case, but it would also be necessary to demonstrate that proposed construction projects were integrated within environmentally-oriented regional land use plans jointly prepared by State environmental protection agencies, regional planning agencies and the transportation planning agencies.

A less structured organizational response would involve the establishment of a series of joint interagency programs as described above, but within the context of the present disaggregated organizational structure that now exists in the Federal agencies. For example, instead of establishing a single EPA environmental land use planning office which would have responsibility for all waste management activities insofar as they are susceptible to abatement and control through land-use regulation, the responsibility for the establishment of interagency programs could be dispersed among the EPA Office of Air Programs, Office of Water Programs, Office of Solid Waste Management Programs, etc. In effect, the precedent established by the EPA-HUD wastewater facility construction program would be repeated for each of the media and categorical programs individually, and similar liaisons would be established between EPA offices and other Federal land use-oriented agencies. Sets of guidelines, a planning grant mechanism and programs to develop and disseminate information concerning techniques and procedures for environmental land use planning and regulation would be required.

Local and State Response

The alternatives described above are all characterized by what has become a classical pattern of Federal intervention in, or promotion of, State, regional, and local activities in order to induce a socially beneficial result. Land use regulation presents special problems in this regard, since, with the exception of Federal control of the use of public lands, it has traditionally been implemented at the local levels of government by municipal zoning boards and building departments, or as a result of the construction of highways, airports, wastewater collection systems, etc. The localized character of land use regulation might be preserved but augmented to include environmental protection features if, instead of reproducing the classical Federal-State-regional-local heirarchy outlined above, the Federal posture were more analogous to that of the Atomic Energy Commission or the Federal Power Commission, which function in a regulatory capacity. In order to ensure that the local and regional institutions which directly or indirectly regulate land use employ appropriate environmental impact assessment techniques and conduct effective regulatory activities, the Federal Government could develop and disseminate guidelines, techniques and environmental reporting procedures. Once these were implemented at the local level, the Federal role would involve comparatively passive regulatory activities rather than active land management program administration.

Summary

This document has outlined the case for integrating land use planning and regulation with environmental protection and has indicated some of the legal, institutional, organizational, and technical aspects of this approach to the preservation of environmental quality. The conclusions which can be drawn from it and from the present state of environmental land use planning can only be of the most general nature, but from the examination of this issue it is clear that:

(1) There is a growing recognition of the need to subject public and private decisions regarding land use to a much closer scrutiny with regard to their environmental implications.

(2) A great deal of legislative and organizational activity has taken place in the past few years regarding this issue.

(3) An array of evaluative techniques now used either for land use planning or for environmental planning may be of potential use in formulating environmental land use policies.

(4) If land use guidance and environmental protection objectives are to be integrated, programs for merging the procedures and practices of groups involved in these functions must be developed.

(5) The feasibility of employing land use as a means of environmental protection, as well as its eventual effectiveness, will depend very heavily on how effectively appropriate liaisons can be established between responsible agencies at the Federal, State and Local levels.

Statement on the Relationship Between Environmental Quality and Land Use

I. Relationship of Environmental Quality with Land Use Planning and Implementation

The Boards find that there is a significant but complex and poorly understood relationship between land use decisions and environmental quality. Public and private activities and determinations as to the use that will be made of a given area of land can make it difficult for us to reach desirable or even acceptable levels of environmental quality either now or at any time in the foreseeable future. This situation will almost certainly continue to be true unless the implications on overall environmental quality are made an important factor in decisions as to uses of land.

Recommendations

The Boards believe that means should be developed to bridge the gap between current land use decisionmaking and the national efforts to enhance and protect our environment.

II. Attitudes Toward Land Use

As a result of the deterioration of the environment in such areas as air, water, solid waste, and noise, and in view of the inherent relationship between these concerns and land use, there is a growing realization that a joint commitment by certain public and private interests recognizing land as a resource as well as a commodity is required if we are to ensure environmental enhancement.

Recommendations

The need to maintain proper land use requires a reappraisal of private and public land as a resource, as well as a commodity.

III. Coordination of and Between Federal Agencies

A number of Federal agencies have statutory responsibility and decisions which in certain cases may affect our ability to achieve environmental quality. Decisions on management and use of Federal lands, on the issuance of Federal licenses or permits, or on the awarding of grants or contracts can have significant impacts on land use decisions affecting environmental quality. Although the National Environmental Policy Act, and court decisions interpreting that Act, have generally broadened the range of land use issues considered by Federal agencies in their decisionmaking processes, it appears that in many cases these important decisions are made without sufficient interagency coordination. This can often result in inadequate consideration of environmental values affected by these decisions.

From The Relationship Between Environmental Quality and Land Use, a report of meetings held by the President's Water Pollution Control Advisory Board and the President's Air Quality Advisory Board, March 27-31, 1972. (Environmental Protection Agency) Appendix 2.

Recommendations

The Boards recommend that coordination be improved between Federal agencies making land use decisions, and other Federal agencies, especially the Environmental Protection Agency in its role as the Federal agency responsible for laws and standards in the area of air quality, water quality, solid waste management, and noise. One method of accomplishing these ends is through formal interagency agreements between Federal entities involved in environmental issues.

IV. Role of Federal-State-Regional-Local Government in Land Planning and Implementation

With various notable exceptions, government organizations at all levels have not adequately developed and carried out comprehensive land use plans that properly protect the environment. The Boards have concluded that there is an inescapable relationship between land use and environmental quality that requires close cooperation, coordination, and assistance between governmental agencies at all levels.

Recommendations

The Boards recommend that the Federal government provide:

1. Land use guidelines including attention to:
   a. Environmental needs in the large, built-up metropolitan areas.
   b. The differential costs and benefits for different sectors of the population.
   c. Standards to guide State decisionmaking in an equitable treatment of those costs and benefits.
   d. The implementation of effective controls.
2. Financial assistance to State and/or regional and local governments for developing and implementing comprehensive land use plans.
3. Sanctions applied to States unwilling to carry out effective land use programming.

The States should provide criteria as well as financial and technical assistance to regional and local governments in their land management efforts.

V. The Environmental Protection Agency's Role in Land Use Planning

The Environmental Protection Agency has an important influence in determining how land is used by virtue of the standard setting process associated with the air and water pollution control legislation. Through the standard setting mechanism, environmental constraints are imposed upon land use. Consequently, States and local governments are affected as are Federal programs and actions.

Recommendations

1. That the Environmental Protection Agency move purposefully to improve coordination with other Federal agencies whose activities affect or are affected by air and water quality standards; provide more environmental planning guidance to Federal, State, and local agencies together with close coordination and

cooperation with local, regional, and State land use planners and policy makers; and make full use of present authority to affect land use decisions with respect to all environmental quality.

2. That the President's Air and Water Quality Advisory Boards continue to assess and evaluate the complex relationships between land use and overall environmental quality, and define the role of the Environmental Protection Agency with respect to present land use planning and future possible regional land use policy.

VI. Socio-Economic Considerations

Speakers appearing before the Boards and discussions among the Board members evidenced general agreement that land use planning and control for environmental protection at Federal, State, and local levels should involve appropriate consideration of socio-economic policies as well as physical and technological measures. Some of these socio-economic policy factors as alternatives to the application of control technology are population movements, resource distribution, and location of sources of pollution.

Recommendations

1. That Federal policies and programs on standard setting, grants, contracts, public works, regulation of and investments in Federally owned or controlled lands, and preparation and review of environmental impact statements require the consideration of the effects upon population concentration, distribution of resources such as inter-basin water diversions, energy production and distribution, transportation systems, and locations of industrial plants and employment opportunities.

2. That a socio-economic impact statement covering the above considerations be required as a companion to and equal in importance to present environmental impact statements. In this connection the Federal agencies concerned should conduct studies of the cost-benefit advantages of such socio-economic planning and control devices as contrasted to the cost-effectiveness of the installation of "end of the pipe" control technology.

VII. Pending Legislation Concerning a National Land Use Policy

The Boards recognize that several legislative proposals to establish a National Land Use Policy are presently under consideration by the Congress. While differing significantly in the manner in which they would accomplish their purposes, bills which are now receiving serious consideration generally reflect the view that although the primary responsibility for land use planning must be placed at the State level, the Federal government should exercise leadership in this area by providing funds to assist the States in their planning efforts, by establishing criteria to guide them in planning, and by invoking sanctions if necessary to ensure that these criteria are followed.

Recommendations

The Boards commend the President and the Administrator for their support of early enactment of legislation to establish a national land use policy. We believe it imperative that any such legislation be so structured as to require land use plans at all levels of government to be developed from the outset in a manner which will, as a minimum, ensure compliance with applicable environmental laws and standards, including air and water quality standards and implementation plans. In connection with such legislation, the Boards urge that consideration be given to means for direct support of land use planning by those large metropolitan areas that request such support providing that the requesting agencies can demonstrate an ability to work within general guidelines consistent with national policies which are provided by the Federal government. If such legislation is enacted, we recommend that the Administrator make the resources of the Environmental Protection Agency available to States and local governments to assist in the formulation of land use plans to meet environmental objectives, and in the review of plans for consistency with applicable laws prior to Federal approval.

VIII. Information and Education

The availability and exchange of valid information regarding the interactions of land use and environmental protection must be increased to land use planners and decision makers and the public at large. If the importance of environmental problems is not recognized, they cannot be adequately addressed. A more informed public, participating in both planning and political decisions, could raise the visibility of the issues and strengthen the prospects for implementation of land use decisions.

Recommendations

1. The importance of environmental considerations as a part of the planning process be brought to the attention of appropriate officials at all levels of government.

2. An information program be directed toward the general public.

3. Methods be developed that will aid the planner in quantifying the environmental impact of his plan.

4. Better institutional arrangements are needed for decision makers to participate in the planning process.

IX. Development of Required Scientific Knowledge

A consistent theme running through the presentation of many witnesses that appeared before the Boards was the absolute necessity for the development of new knowledge in many fields if satisfactory land use and environmental planning is to be accomplished now and in the future.

Recommendations

The Boards recommend that the Federal government and in particular the Administrator of the Environmental Protection Agency take those steps necessary to assure the development of plans for and the funding necessary to obtain the new scientific knowledge required to determine strategies for dealing with the preservation of our environment.

Environmental Performance Criteria for Land Use Planning

The public interest in the environment is far more than the issue of pollution control. With the interrelationships between social, economic, and natural environments becoming more apparent and better understood, it is becoming equally clear that continued concentration on higher forms of technology to abate pollution at its source is a necessary but not a sufficient method of protecting the environment. An effective public program will be one that addresses the causes of environmental degradation rather than merely the effects, and one that is preventive rather than remedial. The need is for a comprehensive environmental management program at all levels of government.

Constructing such a program will be difficult and complex. Fortunately many elements now being produced will contribute to a full scale effort. This proposal is concerned with one of the numerous elements that will fit within the larger program.

Land resource management appears to be the next major subject for the public environmental agenda. Land, like air and water, is a resource. There is a finite amount of it, and it is essential to our survival. There are, however, two important differences between the air and water resources on the one hand, and land on the other: (1) land is privately owned while air and water are generally considered in the public domain; and (2) the primary value of air and water is in their response to natural laws of transport while the primary value of land is largely derived from man-made transportation and other systems, making land as much a cultural phenomenon as a natural one. In the case of air and water we degrade its quality by putting things into it that limit its usefulness. In the case of land, we diminish its utility by extracting resources from it and by limiting its capacity to serve society by the decisions we make about how it should be used.

Historically, land use planning and control has been largely concerned with land as an economic and cultural phenomenon. The prevailing view of land was that of economic, two-dimensional space. There was little concern for the features and processes of the natural environment which serve to differentiate one parcel of land from another. The plans and regulations were (and are) primarily based on its economic and social utility and were concerned with accommodating man-made structures and uses.

This limited approach to land use planning is no longer satisfactory. The natural characteristics of the land will have to be considered as much as its economic and social value. A new kind of land use planning is needed which goes beyond the task of allocating space for economic activities. As part of a larger environmental management program land use planning will have to consider ways to:

1. *Prevent or minimize air and water pollution.* The location of both area and point pollution sources can significantly affect local concentrations of pollution

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The above is taken from the project narrative statement of a proposal by the American Society of Planning Officials to the Environmental Protection Agency for funding of a research project.

and the dilution capacity of the air and water. Similarly, the form and general design of cities and location and types of transportation routes may increase or decrease air and water pollution directly, and through the effect on energy consumption.

2. *Reduce threats to life and property.* While planning has considered the hazards created by ignoring natural environmental conditions, even this attention has been uneven and insufficient. Construction of dwellings in flood plains has increased the frequency and severity of floods; homes built on weak or excessive slopes creates land slippage, erosion, runoff and other serious problems; whole communities are constructed atop and adjacent to major fault lines; waterfront development and filling for intensive uses pollutes rivers, lakes, and estuaries. The list of ways that man himself suffers as a result of his mismanagement of the natural environment is long and serves as a serious indictment of the way he has used the land resource.

3. *Preserve and protect soil and mineral resources.* The process of creating geologic resources is measured in the eons of geologic time; its destruction and mismanagement is measured in months and years. Strip mining, clearcutting, excessive use of pesticides, construction on prime agricultural land, the loss of extractive sites through urbanization, wasteful use of resources, and so on, are examples of issues that environmentally conscious land use planning needs to address.

4. *Protect unique and fragile environments.* Land use planning has given only offhand attention to the need for protecting fragile environments. Wetlands have been viewed as sources of cheap land rather than in terms of their wildlife habitat and water storage functions; the remaining prairies in the great plains give way to development; coastal dunes are seen as sources of sand and potential resort communities; wilderness areas are ideal for all-terrain vehicle use; even historic sites and buildings are levelled in the name of progress. The scientific, historic, recreational, aesthetic, and other heretofore nonquantifiable values are being lost due to lack of consideration in the planning process.

Partly as a result of the passage of the National Environmental Protection Act with its attendant requirement for environmental impact statements, there has been an awakening of interest in the relationship between land use and the environment. By now, virtually every federal agency has developed procedures for assessing environmental impact. Conferences and workshops have been held on the subject, and monographs of all types have been written. Older research efforts on the subject are being reviewed, and new research programs are underway. Past practice is being evaluated.

The environmental impact statement, however, and the methods developed to prepare it are responsive; they come into play only after the project or proposal has reached the final stages of development, at a point when the initiating agency has already committed time, energy, money, and manpower to the effort and is psychologically committed to the proposal in its present form. The environmental impact statement is an attempt to inject environmental sensitivity into the decision-making machinery. It is, however, a tactical approach rather than a strategic one. It suggests that environmental quality as a public policy has not been institutionalized into the decision-making framework, and, until it is, proposals will have to be reviewed for their effect on the environment.

An effective environmental management program would have no need for impact statements. Environmental concerns, just like economic, social, and political concerns, would be an integral part of the total decision-making effort. The environment would no longer be an afterthought.

The individuals and institutions with public responsibility for land use planning and control are concerned about the environment, but their concern has not been translated into the specific actions needed to internalize environmental quality within the planning/decision-making process. The land use planner and policy maker needs facts and figures, sources of information, access to expertise, and technical assistance if the traditional ways of planning are to be changed.

Integrating Promising Approaches in a Guidance Systems Framework

Edward J. Kaiser, Karl Elfers, Sidney Cohn, Peggy A. Reichert,
Maynard M. Hufschmidt, and Raymond E. Stanland

Local governments have a sense of commitment and responsibility but they have not received much support, credit, or glory for their efforts. Nevertheless, a portion of the agencies in this critical link in our societal commitment to the environment have been innovative on their own. They, as well as other planning agencies searching for better ways, need support and a better intergovernmental framework within which to develop an effective local urban governmental guidance system.

As our survey suggests, however, there is a need for increasing levels of expertise at the local level if this link in the intergovernmental chain is to be strengthened. This need might be fulfilled through increasing the environmental dimension of curriculums in planning schools, in-service training programs for planners in the field, and professional development programs. . . . The survey further indicates that planners believe there is a need for programs to increase the awareness of the public, local officials, and other professional bureaucrats in local government.

In addition to the need for coordination among the various levels of government, there is a need for more coordination among local units at a regional scale and especially among various public agencies within the local unit. The decision-making and implementation responsibility for the action instruments tends to be diffused and often conflicting at the local level among many different agencies, e.g., city manager's office, planning department, public works department, health department, tax office, and in some cases, a separate environmental protection agency. This suggests the need for a framework for coordinating the planning and implementation of the various action instruments. This leads to a recommendation.

Recommended:

The Urban Environmental Guidance System as a Framework for Integrating Promising Approaches to Planning and Implementation

Primarily the purpose of this recommendation is to highlight a conceptual framework for general urban environmental planning. The local of metropolitan planner can use this framework to organize a strategy of more specific cutting edge approaches appropriate to the current problems within his agency's jurisdiction. . . .

The environmental guidance system planning process . . . consists of a series of successive planning activities and corresponding outputs which evolve from one another in a cumulative and nested fashion. The ultimate purpose of the guidance system is to establish a rationally derived framework of conditions and rules which will ensure that urbanization respects environmental goals and objectives Urbanization here includes both urban development processes and day-to-day processes of

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From Promoting Environmental Quality Through Urban Planning and Controls by Edward J. Kaiser, Karl Elfers, Sidney Cohn, Peggy A. Reichert, Maynard M. Hufschmidt and Raymond E. Stanland, Vol. IV, chapter IX, pp. 5-23. An Environmental Agency report, review draft, subject to revision. Not to be cited or quoted.

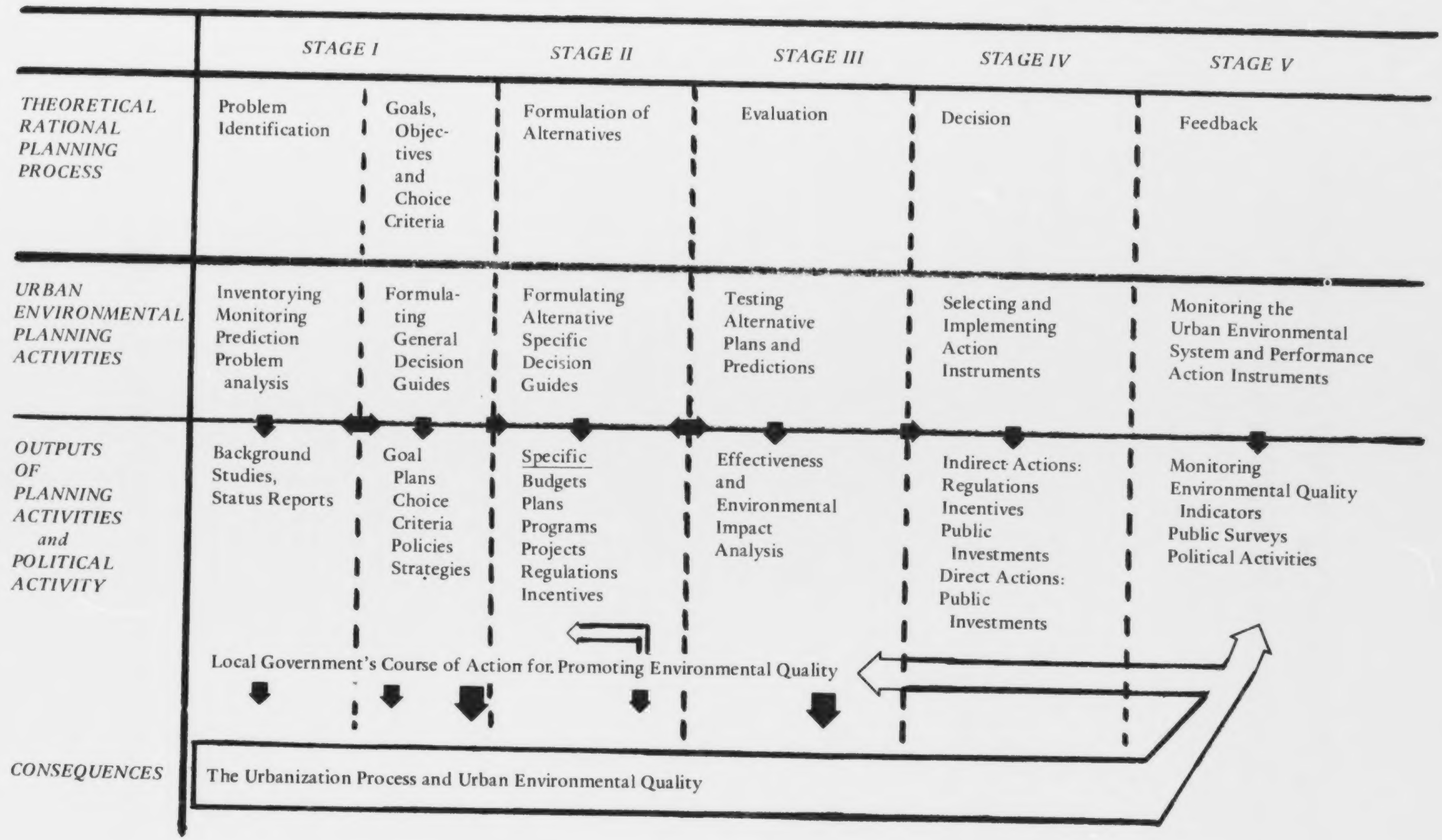
STAGE I
STAGE II
STAGE III
STAGE IV
STAGE V
THEORETICAL RATIONAL PLANNING PROCESS
Problem Identification
Goals, Objectives and Choice Criteria
Formulation of Alternatives
Evaluation
Decision
Feedback
URBAN ENVIRONMENTAL PLANNING ACTIVITIES
Inventorying Monitoring Prediction Problem analysis
Formulating General Decision Guides
Formulating Alternative Specific Decision Guides
Testing Alternative Plans and Predictions
Selecting and Implementing Action Instruments
Monitoring the Urban Environmental System and Performance Action Instruments
OUTPUTS OF PLANNING ACTIVITIES and POLITICAL ACTIVITY
Background Studies, Status Reports
Goal Plans Choice Criteria Policies Strategies
Specific Budgets Plans Programs Projects Regulations Incentives
Effectiveness and Environmental Impact Analysis
Indirect Actions: Regulations Incentives Public Investments Direct Actions: Public Investments
Monitoring Environmental Quality Indicators Public Surveys Political Activities
Local Government's Course of Action for Promoting Environmental Quality
CONSEQUENCES
The Urbanization Process and Urban Environmental Quality

FIGURE IX–I
ENVIRONMENTAL GUIDANCE SYSTEM PLANNING PROCESS

operating an urban society. The planning activities include data inventorying and problem analysis; formulation of general decision guides in the form of goals, objectives, and decision criteria; formulation of alternative specific plans, policies, programs, and projects; the testing of these alternatives; and the selection and implementation of action instruments. The accumulation of the corresponding outputs of these planning activities leads to the implementation of the local government's course of action for promoting environmental quality. The outputs which impact most strongly on the course of action and consequently on the urbanization process are the deicsion guides and action instruments, particularly the action instruments. Hence the impact on urban environmental quality, directly as well as indirectly through influencing the urbanization process, increases through the various stages of the guidance system planning process.

The significant finding of our investigation of the cutting edge approaches is that, with respect to environmental quality goals, the guidance system planning process need not be viewed as simply an abstract planning concept. The conditions necessary for initiating such a planning process are beginning to be fulfilled by the efforts of numerous planners across the country. The guidance system concept merely argues the desirability and feasibility of bringing together these independent innovations in planning methodology and implementation devices. It attempts to organize them into a coordinated local level course of action for promoting urban environmental quality.

An effective guidance system planning process is dependent upon planners and the community possessing a certain viewpoint as much as new planning methods and controls. This viewpoint is characterized by:

(1) an understanding that environmental planning must be process oriented--recognizing that urban and environmental systems are constantly evolving processes--and not simply planning product oriented. Master plans and individual public projects and regulations are not sufficient to an effective planning and action strategy.

(2) a recognition that a multitude of individual decisions made over time within the urban development system and the political system affect the form and function of the urban system and thereby the environmental quality of that system. Planning activity must be geared to infuse an understanding of the environmental implications into these decisions.

(3) a realization that most decisions which define the nature of the urbanization process are private decisions, but that there are points of public intervention which must be used in a systematic and coordinated fashion if there maximum impact is to be effected.

These viewpoints or attitudes must be infused into each stage of the guidance system planning process.

Stage I: *Identification of the Environmental Problem and Definition of Goals, Objectives, and Choice Criteria*

Identification of the environmental problem. The guidance system planner begins by recognizing that the urban environment is composed of a complex set of interdependent natural and man-made elements and processes. Both the natural and man-made subsystems have internal orders of logic of their own. The natural logic or balance must not be disrupted by man's activity nor should the orderly functioning of the man-made urban environment be unduly interrupted by natural processes. Planning must seek to define and promote the most productive balance between urban man and the environment on which de depends.

This recognition provides the basis for an appropriate environmental information system for modeling the urban environmental problem. Such a system should include data, statements of relationships and a capacity for appropriate interpretation of the data. The information system may be used at various stages in the planning process: for example, to monitor environmental trends, predict future conflicts, suggest patterns of urban development from an environmental quality perspective, and determine environmental impact.

To develop an adequate capacity to define environmental problems it is suggested that planners:

(1) include two fundamentally contrasting objectives for which the environmental information system is developed: first, to protect urban processes by identifying environmental constraints to urban development to avoid later interruption of urban processes and second, to protect critical environmental features and processes from being disrupted by urban development. Local urban planners have long developed information systems for the former objective, usually in map form. More recent approaches tend to emphasize the second objective, heavily discounting the former. Few have attempted to encompass both objectives, and that is what must be done in order to fully meet the definition of environmental planning selected by our sample of respondents--"integrating man-made and natural systems."

(2) develop information and an interpretation approach that will be useful at several geographic scales of urban environmental planning problems. It should be useful in locating potential conflicts between development and natural dynamics at the urban regional scale. Such a capacity would address the task of allocating the general location and timing of urban development at the urban region-wide scale. But the information system should also be applicable to environmental planning and action at the scale of the individual site, i.e., at the project scale. Such an information system suggests data and models that are more truly ecological, including attention to biological processes as well as energy and nutrient flows.

(3) seek better data and the participation of environmental experts in creating and applying the information system. A task force approach might be considered to involve the disciplines necessary to inventory adequately environmental resources, monitor natural system trends, and predict possible conflicts between urban system demands and natural system demands.

Establishing Goals and Objectives. Environmental quality should be viewed as one element of the quality of life itself. This implies that environmental objectives should be established openly with public involvement and that planners should strive to delineate the implications of various types of urbanization to the environmental system as well as the implications of various environmental quality goals to other community goals including economic growth and acceptable standards of living. To delineate such implications, it is suggested that planners:

(1) Approach environmental planning as well as all other sector planning with an eye to the multiple objectives of society.

(2) Seek ways to involve the public in a continuous dialogue on community goals. Although much of the environmental planning effort in the near future will be characterized by attempts to achieve goals established at the national level in terms of standards, it will most likely be the responsibility of local planners to relay to the public information on the long term impact of local urbanization on the local environment. Status reports on environmental quality should be circulated to the public at large as well as to public officials via the media, and feedback from the public should be solicited through the use of surveys, public meetings, and representative citizen advisory groups.

(3) Formulate optimum land use plans having an explicit environmental base of information and goals, where land use allocation is based among other things on land capability, compatibility of land use to land as well as land use to land use, and an assessment of potential adverse environmental consequences. These criteria are in turn based on surficial geology, current levels of air, water and noise pollution, hydrology, vegetation, wildlife and physiographic features such as surface water, marshes, flood plains, acquifer recharge areas and slopes.

(4) Formulate separate policy plans for a range of environmental problems and areas which suggest some variation in strategy. For example, remedial action or redevelopment areas might be delineated and applied to both the man-made urban environment and urban infrastructure investments to restore ecological equilibrium. These areas might be distinguished from resource preservation or protection areas. In another approach, area classifications might be based primarily on the basis of differences in development pressures, again suggesting variation in guidance strategies. One recommended classification scheme consists of urban built-up areas, developing areas (where growth pressures are intense), and holding areas where much of the land is in non-urban use and development pressures are not so intense. (Critical resource protection areas which cut across these three categories such as acquifer recharge areas might constitute a fourth type of district.)

The general goal plans, statements of design principles and choice criteria, and policy statements or districts serve as preliminary solution strategy proposals to the key problems identified at the local level. Several steps remain before these strategies have a significant impact on the local government's course of action. While some planners might argue that this is the end point of the comprehensive planning process, the emphasis on implementation in guidance system planning extends planning activity into the realm of more discrete day-to-day decision-making regarding the action instruments and their implementation.

Stage II: *Formulating Specific Alternative Actions*

General goals, policies and strategies must be converted to specific action proposals in order to take on real meaning as a part of the government's course of action. Quite often alternative specific proposals are discussed internally within the planning agency, but rarely are they formally published or presented to the decision-making body as a range of alternatives. In the ideal guidance system process, however, these alternative actions would be discussed openly with and among the decision makers and the evaluation criteria on which a final decision was based would be made explicit. One way to do this would be to involve decision-makers in specifying and ranking the objectives they seek to effect by a given plan, policy, project, or regulation. The planner could then present the decision-makers with a range of alternatives and evaluate each with respect to the objectives. After viewing the alternatives and assessing the implications of each, the decision-makers may desire to reorder their priority on objectives.

The guidance system planning process would also stress an integrated approach to specific action proposals. Single instruments would be considered as part of an integrated system of regulations, incentives and public investments. Combinations of action instruments would be proposed as packages. The concept to be stressed here is that an action proposal is not limited to a single instrument. Every proposal must be considered as part of an incremental change in the context of an already existing course of action or as part of a more comprehensive proposal of changes. Each component is designed to complement the effect of other instruments in the course of action and reinforce, not contradict them.

Stage III: *Testing of Alternative Specific Decision Guides, Action Instruments, and Predictions*

The third stage in a capacity for guidance system planning is the testing of alternatives. The alternative may be a specific plan, policy, program or other specific decision guide of local government; it may be an action instrument or a set of such instruments, proposed or existing; or it may be a forecast based on trends or the introduction of a private or higher level governmental action into the local urbanization process, e.g., the location of a large new industry. This third stage, testing alternatives, is intimately related to the second, formulating alternatives, to the extent that testing may often lead back to a reformulation of alternatives. Hence, these two stages may be repeated in a loop fashion several times before a choice can be made.

Alternatives may be tested for two purposes: first to determine the general effectiveness of the proposal in achieving primary objectives and, second to determine the environmental impact of the proposed action. This latter purpose is particularly relevant to testing private development proposals as well as public plans or projects not primarily aimed at environmental quality goals, e.g., alternative highway routings.

Testing should make explicit the evaluation criteria, including the priority given to each criterion in the evaluation. The testing capacity may also include explicit models of the urban processes and environmental processes being affected and a model of the alternative under consideration in the context of those processes.

An information display matrix appears to be a useful approach until acceptable models become available to aggregate the several environmental subsystems effects across several objectives. Furthermore, relative importance of the several environmental objectives will vary among communities. Given this relativity, methodologies for evaluating environmental impact focus on describing the relationships and interactions in a manner such that the decision-maker can infuse his own perception of relative importance of each impact type into the final analysis.

Stage IV: *Selecting and Implementing Action Instruments*

The fourth stage of guidance system planning involves a choice among alternative action instruments. Choice is also applicable to general and specific decision guides. Nevertheless, a basic premise of the guidance system approach is that planning must eventually come to the action instrument stage if in fact environmental quality is to be affected. The choice of a combination of action instruments is perhaps the most crucial stage in the guidance system planning process.

It is recommended that the action instruments being considered include both the direct and the indirect. Direct action instruments to achieve environmental quality goals are those public investments, such as sewer systems, water supply systems, transportation systems, acquisition of open space, and acquisition of cultural resource areas or structures, which impact directly upon the environment. Indirect action instruments are those regulations and incentives, such as zoning, subdivisions and building codes and taxation policies, which establish a framework of rules and conditions for private, and also public development. Some direct public investments, however, also have an indirect impact, e.g., a sewer system or highway will encourage further urban development nearby and these developments will have an environmental impact. Thus, many public investments exert both a direct effect on environmental quality and an indirect effect by providing the conditions which encourage urban development. Most action instruments for promoting environmental quality available to local government are simply reassessments of rather traditional guidance instruments resulting in their modification, expansion, redirection, or more intensive application. None may be effective in and by itself. The essence of guidance system planning is the design of a series of action instruments which, operating in concert, create an appropriate and adequate set of conditions and rules for urban development and urban activities such as industrial processes and transportation systems to proceed in harmony with public goals.

Action instruments recommended for consideration in controlling location and timing of development for environmental goals are agricultural and conservation zoning, historic district zoning, taxation policies closely related to special district zoning, and, potentially, public investments. Development district zoning or development timing ordinances should be considered as mechanisms for coordinating regulations, taxation, and public investments to control location and timing of development.

Action instruments recommended for controlling the spatial design characteristics of development at the site include density zoning, planned unit development, cluster zoning, inclusion of critical environmental provision in zoning, subdivision, building and health ordinances, special use permits for construction in environmentally sensitive areas or for types of development with a high impact potential, and the requirement of environmental impact analysis on proposed development as a prerequisite to the granting of a rezoning, subdivision plot approval, or building permit. Although these are rather traditional implementation devices, they have seldom been directed towards environmental quality objectives. Furthermore, their enforcement record in the past has been somewhat weak.

Stage V: *Monitoring and Feedback*

The final stage, monitoring and feedback, brings the guidance system planning process full circle. This stage and the inventory activities of Stage I are excellent points for regional and state contribution to the local program.

In summary, we recommend an emphasis on the formulation of a guidance system planning approach by local and metropolitan planning agencies. The rapidity and ingenuity with which local planners have responded to the rather recent emphasis on a quality urban environment even during the brief course of this study may indicate that specific innovations will become standard, if not dated, practice in future years. The necessity to continually revise and improve the elements of the local environmental guidance system will remain a constant in a field of ever-changing variables. But the guidance system concept may provide the mechanism to coordinate new planning approaches in each of the necessary stages and new action instruments for effective environmental guidance.

Specific Recommendations:

The Water Resource-Land Use Interface Planning Activities

In the area of planning for water resource management the key concepts for the 1970s and beyond are closely related to the six criteria for metropolitan water resource management. . . . These criteria include (1) planning for multiple objectives based on the needs of the local jurisdictions and the region, (2) using and considering a wide range of alternative courses of action and multiple purpose projects, (3) coordinating public and private action, particularly to encourage private input at objectives and criteria formulation stages, (4) the use of research and monitoring to better understand the relationships involved in water resource-land use interfaces, (5) the integration of water resource planning into the total planning process of the area, and (6) the coordination or integration of all the local and regional agencies involved in water resource and related land use functions.

In addition to the criteria themselves there are some important concepts and trends that cut across these criteria or are inherent in them. First, regional and river basin water resource planning is becoming, as it must, more urban oriented. That is, specific local urban problems and needs must be given a greater priority in overall river basin and watershed planning. Second, urban or municipal water resource planning must become broader in focus to consider not only relations among water resource functions (e.g., water supply, wastewater disposal, storm water drainage) but relations to other planning sectors (e.g., land use, recreation, transportation) and to other jurisdictions within the metropolitan area. Thus, there is great potential for and some movement toward areawide, integrated water resource management, particularly at the planning level. This is related to the trend toward "systems approaches" in planning and management. Third, planning and management of water resources ought to be (and has been in a few cases) more oriented to formulating strategies and flexible packages of alternatives and policies rather than the production of a single best plan to meet a projected demand. This is particularly true in complex urban areas where growth, demands, and politics are highly uncertain. Finally, there is a need for and a trend toward a more open and clear planning process. Such processes include the detailed data on key environmental factors, the logical formulation of alternatives (via publicized objectives, criteria, principles, data, etc.), and the presentation of alternative solutions with statements of implications for public reaction and evaluation. This is along the line of the trend toward more public disclosure of proposed projects and impacts as required by NEPA.

Decision Guides

A key element in the implementation of the "strategy approach" to planning and management is the use of decision guides. These guides can take several forms but in general they set a framework within which public and private action can be better coordinated and more informed. Some of the main types of useful decision guides follow:

(1) development guide reports - these might take the form of a shoreland development guide or a general watershed development plan illustrated by the approaches of the Southeastern Wisconsin Regional Planning Commission. . . . They explain and define the problems and critical areas, set forth development principles and model ordinances, and offer alternative plans for development; their particular strength (in the case of SEWRPC at least) is in their great store of detailed data (e.g., soils, floodplain) and detailed engineering oriented analysis and design;

(2) strategy plans - these "plans" are less concrete and detailed but offer a wide range of usually quite imaginative alternatives and combinations thereof; they emphasize intergovernmental powers and relations, non-structural measures, and flexibility. . . . In particular they might offer several examples of prototype projects in which multiple means were used to achieve multiple objectives or local

needs through public and private cooperation and at local, state, and federal levels;

(3) policy statements - on the basis of planning efforts, governments or governmental agencies can make public policy statements to establish a framework for both public and private decisions and action; the policies may be at a general level and include broad issues such as economic development vs. ecologic preservation, or at the specific level of where and when utilities should be extended; however, these policies have varying effects depending upon the nature of the policy-making body; in the Twin Cities, where the Metro Council had control over the sewerage system, policies on the extension of lines and location of plants are the potential for guiding private decisions is quite significant;

(4) environmental information - this can take many forms; one is the environmental information directory of Santa Clara County which discusses environmental problems, lists all public and private agencies responsible or interested in them, and defines their powers and relationships; this might also include precise delineation of wetlands or floodplains for public information.

Action Instruments

With the trend toward greater environmental interest, better informed and comprehensive planning, and coordinated management strategies and guidelines, there are a growing number of promising instruments for implementation. Many of these have existed or been advocated for a long time but are now on the verge of much more meaningful use. Some of the more promising instruments follow:

Indirect:

(1) state laws requiring local governments to enact envrionmental regulations, else the states will, e.g., floodplain zoning in California and Illinois; shoreland ordinances in Wisconsin

(2) state and local moratoriums (e.g., Oregon) on development until planning can be done

(3) tax policies to preserve critical areas, e.g., Greenway tax law in Wisconsin (proposed)

(4) effluent changes, especially on industry

(5) permit systems for altering or developing sensitive areas, e.g., wetlands, shorelands

(6) special floodplain regulations in the normal zoning ordinance zones

Direct:

(1) integrated utility systems (especially planning and management), e.g., regional service agency (Maryland)

(2) blue-green development and dual drainage systems (e.g., Denver, Chicago) water is detained on site for multi-purpose use and natural drainage ways are used when possible

(3) wastewater reclamation (Los Angeles, Muskegon) use for irrigation, lakes

(4) low flow augmentation and wastewater diversions (San Francisco Bay)

(5) planned community development and major redevelopment, e.g., railroad on waterfronts (Spokane)

Land Use Planning: The Cornerstone of Local Environmental Planning and Control

Edward J. Kaiser, Karl Elfers, Sidney Cohn, Peggy A. Reichert,
Maynard M. Hufschmidt, and Raymond E. Stanland

Land use planning viewed within the framework of the overall urban planning process is only that sector of planning concerned with the location and intensity of various urban activities. Yet, insofar as land use creates the physical setting for economic and social system activities and is the physical expression of these systems within the environment, its impact is complex and far reaching. Moreover, land use planning should serve as the basis for other physical development planning: open space, transportation, public utilities, public facilities, etc. Because of the fundamental and permeating impact of land use throughout the entire urban arena, land use planning must be comprehensive in terms of the objectives it seeks to further. Land use planning which focusses entirely on the objective of preservation of pristine natural areas is as irrational as that which focusses entirely on minimizing journey time from residential to work areas. The necessity to plan land use within the context of multiple objectives cannot be overemphasized at this time when environmental concerns are presently riding the public opinion tidalwave. Similarly, the cry was heard in recent years for urban freeways to alleviate congestion and rapid suburbanization to alleviate housing shortages. Freeways and suburbs have not solved the transportation and housing problems; moreover, solutions generated within a single objective context may often create as many new problems as they solve. Today's suburbs and freeways, the solutions to yesterday's definition of the urban problem, are viewed by many as the root of today's environmental crisis.

Land use decisions, once enacted into physical development, remain within the urban system for many years. Unless massive urban and suburban renewal every few years is to become the rule of thumb (as in fact some urban observers have proclaimed to be the only option), land use decisions must be made with an eye to placing all objectives within a comprehensive and systematic framework.

The Limits of Land Use Planning

It should be noted that land use planning is only one approach to planning for environmental quality and an approach more appropriate to certain types of urban environmental problems as well as certain types of urban areas. For instance, pollution, which may be viewed as the residual of the overall urban production process, may be abated in three basic ways: through modification of residuals after production (e.g., sewage treatment), through modification of the production process itself to reduce the amount or change the character of the residuals generated (e.g., altering the basic industrial process), or through utilization of the assimilative capacity of the environment to reduce the degradational impact of the residuals generated (e. g., locating industries along the river into which they discharge at sufficient intervals to allow the river to "recover" or assimilate the residuals before receiving another load). The latter approach, utilizing the assimilative

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From Promoting Environmental Quality Through Urban Planning and Controls by Edward J. Kaiser, Karl Elfers, Sidney Cohn, Peggy A. Reichert, Maynard M. Hufschmidt, and Raymond E. Stanland, Vol.II, chapter V, pp. V1-V11. An Environmental Protection Agency report, review draft, subject to revision. Not to be cited or quoted.

capacity, involves land use planning in its generic sense. Implementation devices such as performance standards, erosion control regulations, open space dedication requirements, etc., may also be founded on this concept. Nevertheless, some types of environmental problems are of such character, intensity, or common proliferation that land use planning cannot cope with them. This is often the case in intensely developed urban areas where land use is not subject to easy change and existing conditions make it impossible to plan within the assimilative capacity constraints. Rather, the approach which must be taken is to maintain and enhance the environment wherever possible through pollution control, urban design, urban renewal, historic preservation, and the provision of open space pockets. . . . Land use planning as here discussed, therefore, is a means for promoting environmental quality most appropriate to developing urban areas.

The Purpose of Comprehensive Land Use Planning: The Control of Externalities

When analyzing the process of land use planning in terms of environmental quality objectives, it is useful to define the process in an economic sense. Thus, the planning of land uses is an attempt to interject the notion of the general public welfare into the market interaction between land supply and demand. The objective of this intervention through planning is to maximize the positive externalities resulting from the market allocation of land use and to minimize the negative externalities.

"An externality in economic values arises when the actions of one person or group brings costs or values to another, costs which the person initiating the actions does not have to bear or values which he is unable to capture."[1] Externalities occur in urban land uses because of their interdependent nature. The value of a given land parcel in an urban area is not only a function of the inherent quality of the land in terms of soil type, mineral content, or water resources, but is strongly determined by the locational characteristics of a land parcel in relation to the entire system of urban activities. The value which accrues to the owner of one parcel, whether it is measured in terms of dollars or various types of amenity, is in large part the result of his capturing the external values created by other land owners, both private and public, through their development decisions.

Urbanization, historically, has occurred because of the positive values, or externalities, which could be created in a society by grouping together geographically. The modern urban setting, however, is sufficiently complex in terms of interdependent activities that an activity may be located and conducted so as to take advantage of the positive external values associated with a given location in the urban system, yet in so doing, create its own external effects, some of which may be positive and others negative.

A simplified example may explicate this point. An industry may locate in one area of the city because of accessibility to highways, railroads, and public utilities as well as the appropriate physical characteristics of the site for development (i.e., flat and adequate in size). In so doing, it may reinforce this network of support systems to the extent that they are maintained in good working order or even improved, e.g., the highway is widened because of the demand created by the industry.

This, in turn, makes adjacent land to the industry attractive for additional industrial use or other uses which may benefit from locating near the industry itself or the support system it has strengthened: the opportunity exists to capture the external values created by the industry and public investments which are now associated with a land parcel heretofore valued perhaps only as farm land. Suppose, however, that at the same time, previous decisions were made to build houses in a nearby area because of the locational proximity to the open farm land, another example of an attempt to capture the external value (in this case perhaps amenity values) created by another land use. A conflict may thus arise between home owners in the area who wish to retain the farm land in its present use and industrialists who view the site as prime for development. Meanwhile, suppose that the city, pressured by the need to expand its employment opportunities, rezones the land from agricultural to industrial use and the tax assessor's office, following the city's suit and conscious of its tax base, decides to reassess the value of the land for tax purposes according to its "highest and best use"--in this case, as industrial land. To further complicate the drama, suppose that the land in question may be valuable not only for agricultural use as a point of fresh produce production for the community but is also important to the regional water supply system because a tributary stream to the major river flows through the site. Erosion during construction and the ultimate conversion of natural ground cover to asphalt for a parking area could create runoff problems. If industrial waste were discharged into the stream at this point, even if treated, it could change the flow and temperature characteristics of the river. The change in character of the stream might not be significant in terms of its impact on the quality of drinking water, since it will be treated again later, but suppose the stream runs through a park area presently used for recreational purposes. Suppose that the present farm has located on its grounds one of the original water powered mills in the area and the local historical society has been planning to designate it an historic landmark for preservation. Suppose that the industry which is planning to locate on the site emits some air pollutants, not above that which is allowed by federal law, but which, in conjunction with the emissions from the nearby existing industry, could create a localized air quality problem. The industry also happens to transport materials in heavy duty trucks which must travel through the residential area and are considered noisy by the homeowners.

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[1] Marion Clawson, *Suburban Land Conversion in the United States: Economic and Governmental Processes* (Baltimore: Johns Hopkins Press, 1971), p. 166.

The external effects created by the use of the parcel in question, whether as a farm or industry, could be postulated almost ad infinitum. The various objectives of individuals, groups, and the public at large come into conflict over the use of the land, not simply because of the internal effects on the given site created by the activity, but because of external effects of the land use on other land uses and the subsequent impact on the social, economic, and environmental status of the urban area.

When the conflicts created by this one instance are added to those conflicts arising at various points throughout the developing and redeveloping urban area, the question of land use begins to take on enormous significance. To a certain extent, these conflicts result from the myriad of independent decisions both by private individuals and public agencies concerning land use--independent decisions which are aimed at capturing the positive externalities created by the complex and interdependent urban system but which give little regard to the subsequent externalities, especially the negative ones, created by them. Public agency land use planning is the process of orchestrating these independent decisions in order to encourage and strengthen the positive externalities naturally arising from urbanization while identifying and discouraging if not eradicating the external negative effects.

The Evolution of Land Use Planning

The traditional approach to land use planning begins with a projection of future economic growth in the urban area.[2] This projection is based on trends in both the national and regional economy. It reflects the potential of the given urban area to capture a part of this total growth and in some cases the hope of the community to do so as well. Given the projection in amount and type of economic activity, future population is estimated. These two projections are then translated into estimates of future land demand for industrial, commercial, residential, and public activities. Land supply is evaluated according to suitability and capacity for these various activities. The suitability and capacity of a land parcel is defined in terms of its location or accessibility, size, and general physical quality. Quality denotes environmental characteristics to a varying degree. Some traditional land use plans define quality only insofar as slope and soil characteristics are important cost constraints to development. Flat land and good bearing soil are viewed as prime for intense use regardless of whether the site is located in a flood plain, possesses prime agricultural soil, or is presently a natural forest or wildlife preserve. The basic assumption of this approach is that economic growth will bring positive benefits to the community and that such growth can be best fostered by designing the land use pattern to maximize accessibility within the system of economic activity. Further related assumptions include: (1) an unlimited supply of land suitable for urbanization exists, (2) a city is essentially an economic production unit and should be organized in a manner most efficient for such production, and (3) the negative effects of spatially organizing land use according to economic activity criteria can be assuaged through technological solutions after they are discovered, solutions which an economically productive society will be able to afford.

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[2] See, for example: F. Stuart Chapin, Jr., *Urban Land Use Planning* (Urbana: The University of Illinois Press, 1966); Ira S. Lowry, *Model of Metropolis* (Santa Monica, Calif.: Rand, 1964).

These assumptions began to come under scrutiny in the 1960s when the effect of the emphasis in land use planning on economic system efficiency became more fully disclosed. Pollution in urban areas was high and the cost of reducing it, where it was still possible through technology alone, was extreme. Many forms of environmental degradation, however, appeared more permanent. For example, rich natural areas and farm lands, long accessible points of amenity to urbanities and necessary ingredients to the American definition of the quality of life, were rapidly disappearing as cities expanded through haphazard suburban sprawl across the rural fringe. Furthermore, the very effectiveness of planning characterized by long range master plans to be implemented primarily through zoning came under question.

In response to these criticisms, the land use planning process has evolved in recent years along three distinct yet intimately related axes. First, there has been a continual redefinition of the entire comprehensive planning process of which land use is so integral a part. Secondly, there has been an expanding search for the appropriate criteria on which an optimum allocation of urban space using activities to land should be made, or, as some would phrase it, of land to space using activities. While the more traditional approach stressed criteria which would maximize the efficiency of the urban activity system, the more recent approach emphasizes criteria which will allow for the natural efficiency of environmental systems. The orientation of each approach reflects a basic assumption as to which sub-system, social, economic, or environmental, is most fundamental and crucial to the health of the total system. In part, the two approaches also reflect different values, or priorities, among the many objectives operating in the urban context. While the perfect criteria is subject to debate, it obviously must represent some balance among the various sub-system demands. Thirdly, the emphasis in land use planning has shifted away from simply the design of a long range visionary master plan towards a stress on implementation. Environmental problems have intensified the urgency to make planning more action-oriented.

Together, the trends along these three axes point to the evolution of a planning process aimed at interjecting public objectives, including most recently an environmental thrust, into the urbanization process. We have termed this new planning process "Guidance System Planning."

There is no consensus at present on the most appropriate approach to guidance system planning for environmental quality. There is no inherently correct way in which community goals and objectives should be established, no absolute definition of the type of information necessary for land use-environmental relationship planning, nor is there any one accepted interpretation of information. Furthermore, there is no agreement on the optimal mix and type of decision guides and action instruments which may be generated through this planning process. Yet, it is highly unlikely that there can or even should be such consensus. The appropriate character of guidance system planning for a given urban area should depend on problems encountered, the goals of the community, the needs of the decision-making body, the degree to which public intervention in land development is accepted, and the general level of planning resources available.

National Land Use Policy

Conservation . . . can be defined as the wise use of our natural environment: it is, in the final analysis, the highest form of national thrift--the prevention of waste and despoilment while preserving, improving, and renewing the quality and usefulness of all our resources.

John F. Kennedy
Conservation Message to
Congress, 1962

President's Message to the Congress of the United States, August 1970

Richard M. Nixon

This first report to the Congress on the state of the Nation's environment is an historic milestone. It represents the first time in the history of nations that a people has paused, consciously and systematically, to take comprehensive stock of the quality of its surroundings.

It comes not a moment too soon. The recent upsurge of public concern over environmental questions reflects a belated recognition that man has been too cavalier in his relations with nature. Unless we arrest the depredations that have been inflicted so carelessly on our natural systems--which exist in an intricate set of balances--we face the prospect of ecological disaster.

The hopeful side is that such a prospect *can* be avoided. Although recognition of the danger has come late, it has come forcefully. There still are large gaps in our environmental knowledge, but a great deal of what needs to be done can be identified. Much of this has already been begun, and much more can be started quickly if we act now.

. . . .

Toward a Land Use Policy

Lately, our attention as a people has repeatedly and insistently been seized by urgent concerns and immediate crises: by the sudden blanketing of cities or even whole regions with dense clouds of smog, for example, or the discovery of mercury pollution in rivers. But as we take the longer view, we find another challenge looming large: the mounting pressures of population. Both the size and the distribution of our population have critical relevance to the quality of our environment and thus to the quality of our lives.

Population growth poses an urgent problem of global dimensions. If the United States is to have an effective voice in world population policies, it must demonstrate willingness to face its own population problems at home.

The particular impact of any given level of population growth depends in large measure on patterns of land use. Three quarters of our people now live in urban areas, and if present trends continue most of them in the future will live in a few mammoth urban concentrations. These concentrations put enormous pressure on transportation, sanitation and other public services. They sometimes create demands that exceed the resource capacity of the region, as in the case of water supply. They can aggravate pollution, overcrowd recreation facilities, limit open space, and make the restorative world of nature ever more remote from everyday life. Yet we would be blind not to recognize that for the most part the movement of people to the cities has been the result neither of perversity nor of happenstance, but rather of natural human aspirations for the better jobs, schools, medical services, cultural opportunities and excitement that have traditionally been associated with urban life.

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If the aspirations which have drawn Americans to the city in the first instance and subsequently from the city core to the suburbs are often proving illusory, the solution does not lie in seeking escape from urban life. Our challenge is to find ways to promote the amenities of life in the midst of urban development: in short, to make urban life fulfilling rather than frustrating. Along with the essentials of jobs and housing, we must also provide open spaces and outdoor recreation opportunities, maintain acceptable levels of air and water quality, reduce noise and litter, and develop cityscapes that delight the eye and uplift the spirit.

By the same token, it is essential that we also make rural life itself more attractive, thus encouraging orderly growth in rural areas. The creation of greater economic, social, cultural, and recreational opportunities in rural parts of the country will lead to the strengthening of small cities and towns, contributing to the establishment of new growth centers in the nation's heartland region.

Throughout the nation there is a critical need for more effective land use planning, and for better controls over use of the land and the living systems that depend on it. Throughout our history, our greatest resource has been our land--forests and plains, mountains and marshlands, rivers and lakes. Our land has sustained us. It has given us a love of freedom, a sense of security, and courage to test the unknown.

We have treated our land as if it were a limitless resource. Traditionally, Americans have felt that what they do with their own land is their own business. This attitude has been a natural outgrowth of the pioneer spirit. Today, we are coming to realize that our land is finite, while our population is growing. The uses to which our generation puts the land can either expand or severely limit the choices our children will have. The time has come when we must accept the idea that none of us has a right to abuse the land, and that on the contrary society as a whole has a legitimate interest in proper land use. There is a national interest in effective land use planning all across the nation.

I believe that the problems of urbanization which I have described, of resource management, and of land and water use generally can only be met by comprehensive approaches which take into account the widest range of social, economic, and ecological concerns. I believe we must work toward development of a National Land Use Policy to be carried out by an effective partnership of Federal, State and local governments together, and, where appropriate, with new regional institutional arrangements.

Environmental Protection Permit Legislation

Senator Edmund S. Muskie

One of the areas of public policy which demands attention we have not given is the development and protection of the Nation's limited land resources. It is true that the Senate has considered and passed legislation to require the States to develop land use policies; but, once again, this legislation would have delegated almost unlimited discretion to the executive and to the States to decide what was good land use and what was bad land use. Once again, the Congress would have passed the buck--with no instructions on what to do with it.

The task of creating policies to regulate land use decisions cannot be left solely to the States or to the executive. The buck stops here--in the Congress. Only here can the Federal interest in the public health and welfare be balanced against private decisions regarding property use. Only here can land use regulatory policies be set that take into account all the conflicting interests and make the appropriate tradeoffs from a national perspective.

There is no question of the need for such a policy and for regulation of land development decisions based on such a policy. In fact, such a regulatory mechanism is required in both the Clean Air Act and the Water Pollution Control Act. Implementation plans and programs under both acts must include, where necessary, land use controls. Uncertain land use policies regarding the development of land resources and the need for effective regulatory procedures also lie at the root of our difficulties in solving the energy crisis, in dealing with transportation problems, and in preserving biologically productive land areas.

Just as Congress has recognized that the problems of air and water pollution respect no State boundaries and demand national solutions, so, too, we are now realizing the national scope of our energy and transportation crises. It is time, however, that we also recognized the national scope of other problems which result directly from our lack of a national policy to regulate our use of limited land resources:

The quality of rural life is increasingly threatened as local citizens are crowded off the land and out of their houses by wealthy vacationers seeking recreational property and rural homes.

Highway construction and urban renewal programs devised without respect for people's lives and communities have robbed city dwellers of open space, recreational opportunities, pleasant surroundings and often their homes.

Commercial and industrial site selection decisions have transformed and often permanently degraded large areas of land, simply because inadequate consideration was given to the effects of the attendant transportation, energy, housing, and waste treatment needs of the people who would come with the development.

Senator Muskie made these remarks in introducing his *Environmental Protection Permit Legislation* to the Senate, February 7, 1973. The "Environmental Protection Criteria" are taken from Section 602 of the proposed amendment.

Unplanned development and land use has destroyed flood plains, valuable wetlands, timberlands, and farmlands.

These are national problems; and until we set basic regulatory policy on a national level, these problems will continue to plague us. It is not enough for Congress to say that land use planning is good public policy--though land use planning is essential; and it is not enough to require the States to develop land use plans of their own--though they must act expeditiously to develop such plans. Those kinds of decisions are not really decisions at all; they merely are new applications of the same old, bad habits in failing to cope with yet another pressing issue. Pronouncements of rhetoric have never constituted effective, substantive policy. Nowhere is this truth plainer than in our experiences under the National Environmental Policy Act; although that law has provided some valuable procedural protections, it offers no relief from bad decisions which are a product of good procedure--because it contains no enforceable standards and guidelines against which to measure those decisions.

We should not make the same mistakes in developing national land use regulatory legislation that we have made in other areas; we cannot afford to. We must not sit still and allow the States or the Federal bureaucracy to create fragmented, disoriented, and often contradictory regulatory policies and programs which will permit private, selfish decisions to exacerbate critical national problems and override the public interest.

The bill which I introduce today, the Environmental Protection Permit Act, would require the establishment of regulatory mechanisms at the State level to review private land development decisions, and it would establish in law specific criteria against which to assess those State programs and to permit or deny them to take effect.

Under the provisions of this bill, which would become title VI of the Water Pollution Control Act, the Environmental Protection Agency would be prohibited from making grants for the construction of waste treatment facilities under the Water Pollution Control Act, delegating control of water pollution permit programs to States, or granting extensions of deadlines for meeting air quality standards under the Clean Air Act in any State which does not have an approved program for granting environmental protection permits. This enforcement provision is, of course, subject to refinement, but it recognizes the fact that effective air and water pollution control requires the effective regulation of our limited land resources.

The specific land use policy criteria set forth in this bill are clear statements of the elements of good land use. They are the product of lessons the Subcommittee on Air and Water Pollution has learned from hearings in Machiasport, Maine, and Lake Tahoe, from the development and implementation of the Clean Air Act and the Water Pollution Control Act, and from years of hearings on the economic and social roots of environmental pollution. They are by no means complete in setting forth all the necessary guidelines, but they are a set of criteria from which we can refine an effective set of final guidelines.

The provisions of this bill also reflect beginning efforts which have been made to regulate land use in several States, particularly the State of Maine. In establishing the land use regulation commission in 1969, Maine assumed a position of national leadership in resource analysis and mapping, comprehensive planning, establishment of land use standards and land use districts, and enforcement. The Maine Land Use Regulation Commission establishes standards for and restraints upon the use of land in the unorganized townships of the State, 49 percent of Maine's total land area and more than 10 million acres.

Coupled with the site selection permit program administered by the State's environmental improvement commission, the LURC has given the people of Maine an opportunity to protect their public property rights against private waste.

Nothing is more central to the development of a national growth policy and to the preservation of a livable environment than effective land use planning and regulation. As Dr. George Wald has said:

There is nothing more valuable in the Cosmos than an acre of land on earth.

Unless we in Congress understand and act on our responsibility to make the hard, tough policy decisions which we were elected to make, we and our children will be witnesses to the defenseless waste of that land. . . .

Environmental Protection Criteria from the Bill

"(c) The Administrator shall not approve a State environmental protection permit program which does not assure compliance with the following environmental protection criteria:

"(A) public or private development will be permitted only if in the process of development, and in the completed project, the development will not result in violation of emission or effluent limitations, standards or other requirements of the Clean Air Act and this Act;

"(B) industrial, residential or commercial development will not occur on agricultural land of high productivity, as determined on a regional basis by the Secretary of Agriculture, unless specifically approved by the Governor as necessary to provide adequate housing for year-round residents that would not otherwise be available;

"(C) industrial, residential or commercial development will not occur where it would exceed the capacity of existing systems for power and water supply, waste water collection and treatment, solid waste disposal and resource recovery, or transportation, unless such systems are planned for expansion and have adequate financing to support operation and expansion as necessary to meet the demands of the new development without violation of the emission or effluent limitations, standards or other requirements of the Clean Air Act or this Act at any place where such expansion of such systems or any activities relating thereto may occur;

"(D) redevelopment and improvement of existing communities and other developed areas is favored over industrial, commercial, or residential development which will utilize existing agricultural lands, wild areas, woodlands, and other undeveloped areas, and that development contrary to these principles shall be allowed only where specifically approved by the Governor as necessary to provide significant and permanent jobs, year-round housing, and educational opportunities for low and middle-income families;

"(E) no industrial or commercial development shall occur only where there exist adequate housing opportunities, on a non-discriminatory basis and within a reasonable distance of any such development, for all persons who are or may be employed in the operation of such development;

"(F) no development shall occur on water-saturated lands such as marshlands, swamps, bogs, estuaries, salt marshes, and other wetlands without replacement of the ecological values provided by such lands;

"(G) there shall be no further commercial, residential or industrial development of the flood plans of the navigable waterways in the state;

"(H) those responsible for making less permeable or impermeable any portion of the landscape will be required to hold or store runoff water or otherwise control runoff from such lands so that it does not reach natural waterways during storm conditions or times of snow-melt;

"(I) to the extent possible, upland watersheds will be maintained for maximum natural water retention;

"(J) utilities, in locating utility lines, shall make maximum possible multiple use of utility right-of-way; and

"(K) any major residential development will include open space areas sufficient to provide recreational opportunities for all residents of the proposed development.

"(d) A State may exempt from the requirements of an environmental protection permit program any single family residential building constructed by a person on land owned by such person and intended to be his principal residence on a year-round basis, where such person has not, within the previous five-year period, constructed another such residential building which was or would have been eligible for exemption in accordance with the provisions of this sub-section. . . ."

Land Use Policy and Planning Assistance Act of 1973

Senator Henry Jackson

The Land Use Policy and Planning Assistance Act of 1973 is of critical importance if this Nation is to meet the increasing pressures of industrialization, technological advances, population growth, and rapid urbanization, and to attain our economic, social, and environmental goals. As land use increasingly becomes the focal point for conflicts over national, State, and regional goals, public officials and private citizens alike view with dismay the chaotic, ad hoc, short-term, crisis-by-crisis, case-by-case land use decisionmaking employed all too frequently today.

Sobering statistics suggest that, unless our land use decisionmaking processes are vastly improved at all levels of government--local, State, and Federal--the United States will be unable to meet the emerging land use crisis. Over the next 30 years, the pressures upon our finite land resource will result in the dedication of an additional 18 million acres or 28,000 square miles of undeveloped land to urban use. Urban sprawl will consume an area of land approximately equal to all the urbanized land now within the 228 standard metropolitan statistical areas--the equivalent of the total area of the States of New Hampshire, Vermont, Massachusetts, and Rhode Island. Each decade, new urban growth will absorb an area greater than the entire State of New Jersey. The equivalent of 2-1/2 times the Oakland-San Francisco metropolitan region must be built each year to meet the Nation's housing goals. In the next two decades, one industry alone--the energy industry--will require vast areas of land: New high-voltage transmission lines will consume 3 million acres of new rights-of-way, while at least 225 new major generating stations will require hundreds of thousands of acres of prime industrial sites.

In short, between now and the year 2000, we must build again all that we have built before. We must build as many homes, schools, and hospitals in the next three decades as we built in the previous three centuries. In the past, many land use decisions were the exclusive province of those whose interests were selfish, short-term and private. In the future--in the face of immense pressures on our limited land resource--these land use decisions must be long-term and public.

These and other statistics made it strikingly evident that, to avoid a national land use crisis and to advance a design calculated to meet, without dictating, national goals, values, and requirements, we must enact legislation to assist State and local governments to improve their land use planning and management capability. . . .

Russel Train, Chairman of the Council on Environmental Quality, stated:

> It is a matter of urgency that we develop more effective nationwide land use policies and regulations . . . Land use is the single most important element affecting the quality of our environment which remains substantially unaddressed as a matter of national policy. Land is our most valuable resource. There will never be any more of it.

Senator Jackson made these remarks in introducing his *Land Use Policy and Planning Assistance Act of 1973* to the Senate, January 9, 1973.

Not only is land finite, but unlike air, water, and many minerals and materials, land too often cannot be "recycled." Mountains carved by strip mines, wetlands dredged and filled, or streams channelized frequently cannot be returned to their former use or beauty. Land, once committed to a use today, be it social, economic, or environmental, may be unable to support uses which our children will find preferable in the future. As President Nixon noted in a letter to me--Congressional Record, September 14, 1972, pages S 14935-6:

> As a Nation we have taken our land resources for granted too long. We have allowed ill-planned or unwise development practices to destroy the beauty and productivity of our American earth . . . The country needs this (legislation) urgently.

Future land use decisionmaking, however, should serve more than environmental values alone. It should not be viewed as mission-oriented either in the narrow sense of fostering a specific set of functional activities or in the larger sense of pursuing exclusively a specific goal, be it protecting the environment, improving social services, or increasing economic benefits. Rather, it must balance competing environmental, economic, and social requirements and values to avoid the costly mistakes of both thoughtless, precipitate development and unwarranted, dilatory opposition to beneficial development.

Many of the most crucial problems and conflicts facing all levels of government in the areas of protection of environmental quality, siting of energy facilities and industrial plants, design of transportation systems, provision of recreational opportunities, and development of natural resources are the direct result of past failures to anticipate public requirements for land and to plan for its use. The economic loss, the delays, the resource misallocations, and the social and environmental costs which this failure to plan has cost the Nation are in large measure unnecessary expenses which could have been avoided had appropriate planning been undertaken earlier. The adoption of the Land Use Policy and Planning Assistance Act of 1973 and a good faith effort by the States to exercise responsibility for the planning and management of land use activities which are of more than local concern will greatly reduce needless conflicts, will avoid misallocations of scarce resources, will save public and private funds, will insure that public facilities and utilities--powerplants, highways, airports, and recreational areas--are available when needed, and will improve State-Federal relations in all areas of mutual concern. . . .

The central purpose of the proposal is to provide Federal technical and financial assistance to the States to encourage them to exercise States' rights and improve their knowledge, institutions, procedures and methods for land use planning and management. The measure also provides important new authority designed to improve coordination between the planning efforts of the Federal Government and State governments.

The grant-in-aid program to the States was reduced by amendment on the floor from $800 million over 8 years to $170 million over 5 years. The grant funds cover up to 66-2/3 percent of the cost of developing the State land use programs for the first 2 years and 50 percent of the cost thereafter--reduced from 90 percent for 5 years and 66-2/3 percent thereafter by amendment.

The State is required to develop a statewide planning process within 3 years. The process must include a data and information base, adequate funding, competent staff, and an appropriate agency to coordinate planning at the State level.

The State is then required to develop, within 5 years of enactment, a land use program which focuses on four categories of critical areas and uses of more than local concern. These areas and uses are considered to be of State interest because decisions concerning them have impacts on citizens, the environment, and the economy totally out of proportion to the jurisdiction and the interests of the local zoning body or land use regulatory entity. These four categories of areas and uses of more than local concern are: first, areas of critical environmental concern--for example, beaches, flood plains, wetlands, historic areas; second, key facilities--for example, major airports, highway interchanges and frontage access highways, recreational lands and facilities, and facilities for the development, generation and transmission of energy; third, development and land use of regional benefit; and fourth, large-scale development--for example, major subdivisions or industrial parks.

I wish to make clear that the act does not contemplate sweeping changes in the traditional responsibility of local government for land use management. Decisions of local concern will continue to be made by local government. However, for land use decisions which would have significant impacts beyond the jurisdiction of the local public or private decisionmakers, the act provides for wider public participation and review by the States, as representative of the large constituency affected by those decisions.

The procedure for, and the nature of, State involvement in land use decisions are left largely to the determination of the individual States. Two alternative but not mutually exclusive techniques of implementation of State land use programs are given: local implementation pursuant to State guidelines and direct State planning. However, the act contains language endorsed by the League of Cities-Conference of Mayors which expresses a preference for the former alternative.

The more innovative State land use laws of recent years support this local governments-State Government partnership. The authority of local governments--the level of Government closest to the people--to conduct land use planning and management is in fact bolstered in the great majority of laws of some 40 States concerning areas and uses of more than local concern--wetlands, coastal zone, flood plain, powerplant siting, open space, and strip mining laws. The localities are encouraged to employ fully their land use controls. State administration review is provided only in accordance with flexible State guidelines relating only to those decisions on areas and uses that are clearly of more than local concern. And even should disapproval of a local government action result from such a review, State preemption of the decisionmaking authority would not necessarily occur; rather, in most cases, the local government would be provided full opportunity to take any of numerous actions which would comply with the State's guidelines.

The proposal would not preclude direct State implementation through State land use planning and regulation. Hawaii and Vermont have already enacted legislation which in part calls for such direct State implementation. Other States are directly engaged in land use planning for unincorporated areas. However, embodied in the measure is the expectation that direct State implementation, preempting local land use planning controls, will continue to be the exception rather than become the rule and that joint local-State government land use decisionmaking and implementation will prevail.

Another point which should be emphasized is that the Federal review of State land use programs is to focus not on the substance of each program, but on whether each State has authority to develop and implement its program and whether it is making good faith efforts to do so. This is in keeping with the proposal's purpose to encourage better and effective land use decisionmaking at the State and local levels, and not to provide substantial new land use decisionmaking authority on the Federal level.

Guidelines for the act are to be promulgated through an interagency process with the principal responsibility of formulating those guidelines residing in the Executive Office of the President. As the proposal provides for a grant-in-aid program of major dimensions which requires administration by line agency personnel, daily administrative responsibility is given to the Department of the Interior. To insure the absence of the mission-oriented bias of any existing office or bureau in the administration of the proposal, the proposal creates a new Office of Land Use Policy Administration within the Department, separate from any such office or bureau.

Certainly, the land use impacts of Federal and federally assisted programs exert the most profound influences upon local, State, and National land use patterns. Yet these programs either have conflicting land use implications or the Federal officials administering them are not fully cognizant of their land use impact. My proposal requires the Federal Government to "put its own house in order" at the same time that it asks the States to do likewise. The Secretary of the Interior is directed to consult with heads of other agencies and to form a national advisory board on land use policy to provide interagency communication concerning the land use impacts of and policies embodied in Federal and federally assisted programs.

The act also encourages coordinated planning and management of Federal lands and adjacent non-Federal lands. Both the Federal Government and the State and local governments are required to provide for compatible land uses on adjoining lands under their respective jurisdictions. In addition, short-term ad hoc joint Federal-State committees, composed of representatives of affected Federal agencies, State agencies, local governments, and user groups, may be established by the Secretary of the Interior to study general or specific conflicts between uses of Federal lands and uses of adjacent non-Federal lands. The Secretary is directed to resolve such conflicts or, where he lacks the requisite authority, to recommend legislative solutions to Congress.

Finally, what is this measure's relationship to other land use legislation which may be introduced this Congress? Approximately 200 land-use policy bills were referred to 13 committees in the 92d Congress. The most important of these measures were: the public lands, the surface mining, the powerplant siting, and the coastal zone management proposals. Virtually all of these bills focused on individual uses or areas of critical concern and more than local significance, and encouraged the States to assume a degree of control over them. In addition, the Congress is giving increasing attention to national growth policy, in general, and various aspects of growth policy such as rural revitalization. In relation to the myriad of land use and growth policy considerations and legislative proposals which Congress may consider, the Land Use Policy and Planning Assistance Act is expected to serve as an umbrella measure or an "enabling act" which would encourage the States to develop the financial, institutional, and human resources, and require of the States legislation to establish the necessary machinery and procedures to insure that, first, the States will be receptive to any of those considerations or proposals which become law, and second, the many planning tasks which such laws will require will be conducted effectively and not in isolation one from another.

Mr. President, the chaotic land use decisionmaking of today will insure an unsightly, unproductive, and unrewarding land resource for future generations of Americans. To avoid this unfortunate tomorrow, we must improve our land use policy, procedures and institutions. I commend the Land Use Policy and Planning Assistance Act of 1973 to the Senate as the best vehicle to achieve this improvement.

A National Land Use Policy: Toward a New Land Ethic

Roger P. Hansen

> "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."
>
> Aldo Leopold
> *A Sand County Almanac*

Introduction

Ecologically[1] irresponsible land use practice arising from generally ineffective land use control--aside from the "growth ethic"--is the basic environmental problem facing America. Land use patterns are the generators, the root causes, of the environmental degradation symptoms of polluted air, polluted waters, and other problems to which we have given infinitely more attention.

Vast areas of the American landscape, including sparsely populated and seemingly environmentally virgin areas of the West and Alaska, are under a state of siege from an army of diverse forces. Triggering factors cannot be overstated: rapidity of change, absence of adequate laws and institutions, a general apathy and unawareness on the part of the public, and accelerating population mobility. The Frontier Ethic--that every man has a right to use his own property as he pleases --still pervades the American Dream.

The basic land use problem might be stated briefly in this manner: *Tremendous and unprecedented pressures, originating from a variety of sources, are producing through carelessness, lack of planning, and lack of awareness, manmade environments and physical changes which are neither sensitive to nor integrated with the delicate character and carrying capacity of the varying ecosystems of the American landscape. Rather than designing with nature, man obliterates it.*

While we have been structuring elaborate institutional arrangements and legal devices to deal with what most people think are THE environmental problems--air quality and water quality--the deterioration of the American landscape continues relatively unchecked: rivers of neon; forests of billboards; tentacles of roadside strip development; acres of sprawling, tasteless subdivisions; strip mines gutting the valleys and scarring the mountainsides. In the state of Colorado, 2 million acres split into tiny lots have in the last two years been put on the television markets of Chicago, Akron, and Los Angeles.

Land use is the most difficult of all environmental problems even to approach, let alone solve. It is guarded by the great, bawling, sacred cow called "private property"; land use planning is an inflammatory phrase in many parts of the country, and land use controls are still considered by many to be some sort of communist plot. Pure air and clean water are becoming recognized as common community property,

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The above is extracted from a paper originally prepared for the National Oil and Gas Institute of the Southwestern Legal Foundation, Dallas, Texas, February 7, 1973.

[1] The term "ecology" or "ecological" as used in this paper refers solely to the scientific study of the interrelationships between organisms (including man), their environment and each other; a branch of biological science. It is nowhere to be construed as a synonym for environment, conservation, aesthetics, or anti-pollution efforts.

subject to regulation, while land use control is held by many to run counter to the "free enterprise system." Many lawyers still challenge the constitutionality of zoning and subdivision regulations although it has been almost 47 years since the U.S. Supreme Court decided *Euclid v. Ambler Realty!*[2]

Blackstone wrote: "Regard for the law for private property is so great. . . that it will not authorize the least violation of it, not even for the general good of the whole community." And in England in the 18th century, the Elder Pitt said that "the poorest man in his cottage could defy the King." All that has changed radically, by the cases and by legislative enactments, local, state, and federal. The King has more than entered the cottage; he has taken a lease and has set up permanent housekeeping.

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The Conventional Legal Wisdom

Many lawyers forget something they were supposed to have learned in law school: that the law is a sword as well as a shield. The law is being rigged as a shield against effective land use control with increasing frequency. For example, the apparent abandonment of police power regulation of signs and billboards in favor of compensation arrangements the public cannot possibly afford is a giant step backwards in legal doctrine.

The conventional legal wisdom dares not venture beyond time-worn traditional devices for land use control.[3] Land use planning under traditional legal devices has revolved around the "master plan" and the "official map."[4] Judicial controls have largely been confined to the doctrines of waste and nuisance which concentrate on extreme or unusually obnoxious or offensive land use interferences but are ineffective to protect aesthetics, wildlife, scenic views, and other more esoteric uses.

Legislative land use controls, with certain protections for the billboard lobby, still rest largely on the police power of the state to protect the public welfare, health, and safety. No compensation need be paid to those regulated so long as the regulation is "reasonable" in meeting the desired ends. Zoning, subdivision regulations, and building codes are prime examples.[5]

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[2] *Village of Euclid v. Ambler Realty Company* 272 U.S. 365, 71 L ed. 303 (1926).

[3] Between private parties, these are: unrestricted transfer of fee simple title; title transfer in trust; creation of an easement; transfer of a leasehold interest; transfer subject to conditions and limitations; and restrictive or protective convenants under contract theory.

[4] *Master Plan*(Comprehensive Plan): a broad survey, a comprehensive look at an area, long range; usually contains: (1) Research and Survey--e.g., physical setting and history, present land use, existing roads and utilities, economic base study and forecast; (2) Plans for Improvement--e.g., economic development program, future land use, circulation plan, community facilities plan, background for renewal; and (3) Plan for Action--e.g., capital improvement and financing program, zoning regulations, subdivision regulations; *Strength:* can give a whole area a sense of direction and purpose: *Weakness:* easy to put on the shelf and forget. *Official Map:* device used to fix building lines, plat future as well as existing streets; subdividers must conform to the layout; *Strength:*more detailed than master plan but still gives direction to future development; city knows where to put utilities; *Weakness:* many municipalities that have one ignore it.

[5] *Zoning:* device whereby land is mapped into areas or "zones" where only a specified use, or lesser-included uses, is allowed (e.g., single family residences, light industrial). *Strength:* clusters uses so as to promote orderly and controlled development without unnecessarily interfering with other uses. *Weakness:* has become a political device, agency responsible may grant rezonings or excessive variances (exceptions to the mapped zones). *Subdivision Regulation:* device that requires one to get the approval of a government agency when he is going to divide his land into lots for sale; the community requires this approval because they want to assure permanence of development, future services, accurate records, safety, health and fiscal consideration; the home buyer and mortgage lender want to protect their investment; the subdivider himself gets protection from excessive platting of lots and the fly-by-night operator. *Strength:* as mentioned above. *Weakness:* soft requirements, poor enforcement by the approving agency. *Building Codes:* device used to insure that proper materials and procedures are used in construction so as to safeguard community health and safety. *Strength:* widespread acceptance by the public; good results in achieving higher quality construction. *Weakness:* enforcement difficult, expensive.

Traditional administrative land use controls include: agency management perogatives over the nation's public lands; exercise of the power of eminent domain; regulation of sanitation by health boards or pollution commissions; and urban renewal authorities' power to condemn and develop. It should be noted that although land use is described in this paper as a generator of most other environmental problems, any significant jurisdiction of the Environmental Protection Agency over land use is notably absent.

Lawyers generally occupy the caboose of the land use control train. The old traditional devices, well-guarded by dusty precedent, are not particularly applicable to today's land use and urban problems: zoning's balkanization of the urban ghetto; tax policies that force a land development spiral; conscienceless fast-buck real estate artists who drain public and private purses; the paucity of legal ideas for new towns and imaginative new development approaches; subdivision regulations that guarantee urban sprawl; and "master planning" procedures that are used primarily as a device for greater growth and economic development.

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A National Land Use Policy

Clearly, land use as a leading environmental issue is at the place where air and water pollution were three years ago. Land quality acts are now going to quickly follow air and water quality acts. Congressmen will jockey for positions and headlines as the leading "land use" legislators. As with air and water quality legislation, the states will be forced to come up to some federal standard of performance. Federal funds will be employed as both carrot and stick. Environmentalists, who have never before been concerned with land use planning, will be going to court on the theory that some contemplated action will "degrade the quality of the landscape."

A. Current Proposals

Current legislative trends are merely old wine in new bottles. While it is not particularly efficient to comment specifically, bill by bill, on rapidly evolving proposals for a Federal land use policy, all of the major proposals--Jackson's, Aspinall's, and the Administration's--have notable omissions and weaknesses:

* The bills fail to clearly set forth national land use policy objectives;

* The bills fail to enunciate even broad federal guidelines for ecologically sane land use planning and decision-making;

* No bill recognizes explicitly that there are certain limitations on the right of private property for the benefit of society and future generations;

* No bill clearly defines federal, state, and local roles in planning and land use decision-making;

* No bill outlines or even suggests guidelines or ingredients for ecologically responsible planning methodologies and procedures;

* No bill outlines specific environmental criteria for land use planning and decision-making;

* All bills are resoundingly silent on the "growth ethic," or the need to limit as well as enhance growth in certain areas as a matter of national prerogative;

* No bill suggests the variety of land use control devices that might be employed, let alone require them to be implemented by state or local governments;

* All bills maximize attention to land use planning and minimize attention to land use controls necessary to implement the plans;

* Out of ignorance apparently, no bill recognizes that neither the Department of the Interior not any other federal agency has the present capability to implement a national land use policy, and that such an institutional capability must be created;

* all bills concentrate on planning grants, advisory groups, information exchanges, and technical assistance programs which have little to do with land use decision-making processes;

* No bill recognizes the necessity of preserving the nation's agricultural productivity from irretrievable commitments to development; and

* No bill provides any powers or procedures for exercising emergancy measures to halt land use decisions that will result in irretrievable commitments of irreplaceable national natural resources.

B. Policy Objectives

Recognizing the deficiencies of current proposals, statement of national land use policy objectives might read as follows:

1. Coordination--within precise federal guidelines--of federal, state, local, and private land use decision-making;

2. Protection of the national interest in ecologically sound land use planning and decision-making;

3. Establishment of a land use decision-making system that is consistent with the ecological carrying capacity of the land;

4. Protection of the biophysical environment from continuing degradation and provision of every opportunity for environmental quality enhancement;

5. Immediate protection of significant ecological, cultural, wildlife, historic, scenic, and open space resources threatened with irretrievable loss or damage;

6. Protection of human, animal, and plant life, and property, from significant environmental hazard;

7. Avoidance or mitigation of air, water, noise, radiation, solid waste, pesticides, and other environmental pollutants;

8. Provision for every American of a healthful environment with aesthetically pleasing surroundings;

9. Provision of a comprehensive, integrated national system of open space, including both developed and undeveloped lands; and

10. Establishment of criteria and a workable program for redistribution of human population, based on the carrying capacity of the land.

The objectives and policies expressed in the National Environmental Policy Act are of course considered to be incorporated in any statement of land use policy objectives.

C. Guidelines for Implementation of Objectives

Guidelines for some reason are frequently confused with "standards" and each are further confused with "criteria." The following suggested guidelines are not criteria and they are far from being standards. Rather, they serve merely as a checklist of actions that should be taken if the above national land use policy objectives are to be implemented.

1. Planning by natural ecosystem units, including river basins, as well as by geographical or political subdivision boundaries;

2. Preparation of state, regional, and national inventories of environmental resources;

3. Establishment of Regional Land Use Coordination offices (perhaps by river basin);

4. Development of reliable information systems for all ecological, economic, and land use information;

5. Requirement for establishment of an interdisciplinary staff for all federal and any federally assisted state planning program, including at least the following disciplines: regional planning, architecture, landscape architecture, plant ecology, animal ecology, fisheries biology, sociology, economics, and law. (The intent of the NEPA with regard to interdisciplinary studies is not being fulfilled.);

6. Development of an ecologically valid land use classification system based on the carrying capacity of the land for certain uses (agriculture, urbanization, transportation corridor, industrial facility, etc.);

7. Utilization and creation of a wide variety of private and public land use control devices: zoning, subdivision regulations, scenic easements, eminent domain, taxing policy, leasehold arrangements, purchase of less than fee, etc. Encourage flexibility;

8. Structuring of new and more responsive devices for public participation in the land use decision-making process;

9. Creation, integrating existing techniques, of a new "land use planning technology" of regionally compatible planning methodologies and procedures (e.g., environmental resource inventory, land use classification, carrying capacity determination, etc.); and

10. Development of procedures to integrate land use planning with land use decision-making; land use planning and land use decisions are frequently unrelated.

Statement before the Senate Committee on Interior and Insular Affairs

Russell E. Train

Mr. Chairman, and members of the Committee, I welcome the opportunity to testify in support of the President's proposal for a national land use policy. In my view, it is a matter of urgency that we develop more effective nationwide land use policies and regulations. Land use is the single most important element affecting the quality of our environment which remains substantially unaddressed as a matter of national policy. Land is our most valuable resource. There will never be any more of it. Rapidly rising human numbers and expectations place rapidly rising pressures on the land. It is imperative that we act now to adopt a national land use policy which will both protect our heritage of irreplaceable land values and provide guidance for future development and growth.

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Before discussing the legislative proposals before us, it might be useful first to examine land use policy in historical perspective, for while we often speak of the need for better land use planning, at the heart of the present dilemma is our regulatory system and it is in this area where the President's legislation would have most immediate impact.

Modern American land use regulation began in New York City in 1916 when Fifth Avenue merchants became alarmed at the pace of encroaching industrial development on the downtown shopping area. As orginally conceived, zoning was a radical departure from traditional notions about private property use, which previously had been circumscribed by little more than the law of nuisance. Ours was a society struggling for order in the midst of dynamic growth, which quickly recognized the need to segregate activities according to compatible uses in order to protect certain established patterns of neighborhood organization.

By 1922, the reformers had won over the Federal government and Herbert Hoover's Department of Commerce issued a Standard Zoning Enabling Act to guide the States in adopting laws to encourage zoning. States responded quickly by enacting laws on the order of that proposed by the Commerce Department, which authorized municipalities, counties and other local governments to classify and control land uses according to a comprehensive plan. The overriding concern of these laws was to make possible local regulation with virtually no State oversight. The constitutionality of the new technique was tested and upheld in 1926 by the U.S. Supreme Court in the historic case of *Village of Euclid* v. *Ambler Realty Co.*, 272 U.S. 365.

During the ensuing forty years the techniques of land use planning and regulation have become more sophisticated. The original system of strict classification and segregation of use has been refined in many areas to permit "floating zones" and some forms of planned unit development which permit mixed uses and variable densities. The static land use plan with colored areas indicating which activities are permitted where has tended to yield to more flexible porcedures which give planning authorities discretion to permit variable uses, densities and designs subject to site plan reviews, performance standards and satisfaction of stated community objectives.

No plan is ever any better than the regulatory apparatus upon which its implementation depends. Zoning is nothing more than a tool with which a group of people, gen-

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erally in a small area, determine what land uses are to be allowed. The land use control or "zoning" process is seldom really based on planning, but rather on what public officials may think significant at a given moment. Plans, even when they are prepared by a State with respect to broad areas, cannot work unless States also control the regulations which give effect to the plans.

However useful new land use control techniques may be, it is impossible to ignore the evidence of poor land use planning and regulation in the United States. There is something clearly wrong with a process which indiscriminately slices up land for development on the urban fringe without regard to its natural characteristics or needs. A system which encourages the steady destruction of coastal wetlands vital to the continued existence of waterfowl and marine life must be reformed while there are still wetlands to save. Land use practices around our metropolitan areas, which are often designed to exclude multi-family housing, privately sponsored educational and charitable activities and even some public enterprises such as sanitary landfills, waste land by obstructing logical patterns of growth, burden those who must travel longer distances to work, and often help perpetuate unsatisfactory conditions of life in the inner city.

We need no new studies to describe the problems. A number of studies considering land use from various points of view have concluded that the difficulty of small units of government to act in concert or to pursue regional objectives is a serious obstacle in the way of an orderly, equitable allocation of land resources. This was the explicit conclusion of the Douglas Commission, whose focus was primarily on the impediments to meeting the demand for housing, and it underlay the conclusions of the National Estuarine Pollution Study, which was concerned with the conservation of coastal wetlands. The fragmented localism that characterizes land use regulation has frustrated both housing goals and conservation objectives.

First, small units of government are inherently limited by the confines of their jurisdiction. Scenic or important natural areas are rarely viewed by a locality in terms of their regional importance. Even when one locality acts wisely to fit development to the capacity of the land, it may not be able to affect the adjoining town's land use control practices. The limits of local jurisdiction are simply not adequate to encompass regional ecological or development systems without some policy guidance from larger units of governments.

The second reason for the inadequacy of local solutions to regional land use management problems derives from the dependency of many local governments upon development-related property tax revenues. Whatever may be in the best interests of the region must confront powerful economic incentives. American cities find it very difficult to act in concert in planning and controlling land use, partly because neighboring communities compete economically.

A third reason for the inadequacy of our current approach to land use regulation has to do with the changing character of the United States. Once it could be said that if one community allowed one wetland to be filled or one woodland to be developed there was always another. This is no longer true. The frontier has long since been closed, but the myth of inexhaustible land resources has survived into an era when it has become clear that our supply of land, especially of lands we refer to in S.992 as "areas of critical environmental concern," is finite.

As a consequence of problems largely beyond the control of local governments, the current locally oriented land use regulatory system is doing very poorly at dealing with three kinds of issues: protecting lands which serve vital natural or aesthetic purposes for a regional population; accepting and siting development which the larger area may badly need but which may represent net tax costs or pose social problems; and controlling growth which is induced on such a scale by certain magnetic developments that it altogether changes the ground rules of the conventional planning and zoning game.

The objectives of a national policy for land use must be to reform the institutions of government in such a way that important conservation areas are protected, vital developmental needs are accommodated, and major developments and facilities are controlled.

. . . .

In devising its program, the Administration is nevertheless sensitive to the strengths of our existing approach to land use management. The vast majority of zoning decisions are indisputably local in nature and they should probably remain subject to local direction. There is no substitute for local control over local problems, and the President has clearly shown that he is sensitive to the deeply felt wish of people everywhere to have closer to home the governmental machinery that controls their lives. Quite precisely, the Administration's proposal seeks to avoid disturbing present arrangements over regulating land use decisions which are essentially local in character by defining and attending to those problems which are inherently regional and Statewide in impact. Locating the local filling station is by no means a matter on which we would encourage State involvement.

An effort to broaden State authority is timely, for during the past several years a number of States have undertaken promising initiatives in land use regulation. State laws designed to protect coastal wetlands from draining and filling began in Massachusetts in 1963 and now exist in a number of coastal States. State controls on large-scale development have been established during the past two years in Maine and Vermont. Laws to control the development of shorelands are in effect in Wisconsin, Minnesota and a part of California, and similar laws are being considered by the Washington legislature. Laws to establish special "areas of critical State or regional concern" have been passed in New Jersey and Colorado and are being considered in New York. Ohio recently passed a Statewide building code designed to encourage industrialized housing. New York and Massachusetts have enacted legislation designed to assure that local regulations accommodate development needed by a larger region. During the 1960s the number of States with planning offices increased from 39 to 50, and this quantitative increase has coincided with a marked improvement in the quality of State planning.

The time is ripe to ask more, and reasonably to expect more, of the States. Certainly some observers are reluctant to see certain functions transferred from municipal to State control, given the early record of States' treatment of their cities, blemished by officious intrusions on the one hand, and by neglect on the other. But this era is largely past. This is not to suggest that local governments should relax their concern with land use, but that many land use problems are too big for local governments to handle. These larger problems require the concern of an agency whose responsibilities are Statewide.

State Land Use Environmental Policies

The air nimbly and sweetly recommends itself unto our gentle senses.

Shakespear, Macbeth

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Toward a State Land Use Policy: Harmonizing Development and Conservation

Richard H. Slavin

Every state is currently involved in an environmental crisis. This crisis indicates a need for state government to develop methods to resolve the constant conflicts that arise between development processes and the needs for environmental preservation and resource conservation.

Rapidly increasing populations are escalating demands on space for housing, industry, commerce, transportation, recreation, agriculture, forestry, mining, water, power and waste disposal. Continuation of present development processes will result in further deterioration of our land, air and water resources to such a point that we may be courting major natural disasters jeopardizing human life itself.

Presently, state land-use policy is an aggregate of thousands of unrelated decisions made by single-purpose agencies, local governments and private developers without regard for each other or regional, state and national concerns.

The goal, therefore, should be to evolve and promote development policies and programs taking into account both people's and nature's needs for the purpose of minimizing the areas of conflict and discovering and enhancing the areas of harmony.

Environmental Preservation and Resource Conservation Issues

Some natural resources are limited, and once used are no longer available. It is, therefore, prudent that these be placed under a management system that seeks the most efficient use of the resource while protecting reserves for the future.

Some resources are renewable if properly managed and, therefore, are considered permanently available if not overused. We are most familiar with the plants and animals used for food, fibre, building, medicines and so forth. Of equal importance because they support the processes that support human life are the smaller animals, plants and organisms--the mosses, lichens, soil bacteria, insects and plankton. Management of the renewable species requires the knowledge of and care for the entire related world of resources.

Natural geological processes generally operate at such a glacial pace that man tends to ignore them--frequently to his consternation and disadvantage. These are the erosion of hills and mountains and the building of valley plains and delta lands, the building of beaches and dunes and wearing away of lands along oceans, and the uplifting and gradual subsidence of lands. Rapid geological changes are volcanic eruptions, earthquakes, landslides, floods and tidal waves. Respect for earthquakes has brought improved structural standards into building codes. Respect for floods and tidal waves has brought special use zones into being. Respect for landslides and severe erosion has brought special hillside development requirements into being. Lack of sufficient respect for these natural processes, however, results in enormous losses, some of which are measured quickly when a landslide kills a family or blocks a highway or a flood wipes out a town. Some losses are more difficult to measure, such as the loss of beaches due to the damming of rivers or the damage to a city because of its gradual subsidence.

This article originally appeared in *State Government: The Journal of State Affairs*, Vol. XLIV, No. 1, Winter, 1971, pp. 2-11.

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All of these problems are of a collective nature requiring collective action. However, government typically reacts to situations after the fact. It has not been able to anticipate and respond to potential problems and gives little consideration to gradual changes which man is effecting. The crux of the environmental crisis is that it may now be too late to continue a policy of reacting only. Government should escalate its position in relation to the environment and natural resources.

Some of the areas demanding continued or new attention are the State's water and air; its seacoast and tidelands; its rivers; its forests and agricultural lands; its wetlands, swamps and estuaries; its fisheries; and its mineral extraction areas.

Public concern has resulted in new legislation dealing with air and water pollution, but has yet to link up its concern on these subjects to land-use issues.

Urban Development Issues and Problems

Characteristic of the last few decades has been the decline of rural areas, deterioration of central city cores and thriving growth of city suburbs in the Nation. It has been a period of gross social and economic inequity, degrading poverty, a crisis in race relations, alienation of youth, enormous environmental pollution, high taxes, high spending, and tremendous industrial and building activity.

An in-city migration of the rural poor with an out-city migration of high- and moderate-income people together with business and industry has resulted in social polarization; inequity in job, educational and recreational opportunities; and a phenomenon called the urban crisis. Lack of job and housing opportunities in the suburbs for the unskilled poor and minorities reinforce the polarization. Land-use controls, specifically exclusionary zoning, have helped to direct the division of society into ghettos and moderately well-off suburbs.

Old city residential, commercial and industrial centers deteriorate into slums and blighted areas far faster than they can be rehabilitated by public or private institutions. Reliance on the automobile and removal of transportation services have created hardening of traffic arteries. Population pressures on inadequately designed sewerage facilities and gaseous wastes pollute streams, lakes, oceans and the air. In the city fringe areas vegetation is stripped, topsoil is buried, streams are channeled into culverts, hills are leveled, valleys and marshes are filled and whole new communities occupy areas which were formerly forested or farmed. The adverse impact of these phenomena on human and natural life and resources is what we call the environmental crisis.

The urban and environmental crises are part of a general crisis involving the economic and social conditions and values of the entire society. Efforts to deal with either part of the crisis inevitably involve the other.

Problems of Urban Growth

The way in which cities have grown of late has been characterized in various ways, but "leap-frogging" is one of the most descriptive phrases for the sprawling pattern resulting from the private ownership of land and the "bundle of rights" which goes with that ownership. Many attribute urban sprawl to speculative activity, but the root cause of urban sprawl is the right to buy and sell land and develop it, for all intents and purposes at will, for lack of other public goals for development. Local governments, under their present planning and zoning regulations, have been unable to cope with sprawl. So, if more reasonable urban development patterns are to be encouraged, it is essential to control the timing and location of growth.

A brief summary of the problems of urban sprawl follows.

* Premature characterization of an area by the prior development of housing, factories or commercial development which subsequently make the area unfavorable for anything but compatible uses. Such characterization is done quite unintentionally

by those trying to avoid high land prices or restrictive regulations in other areas.

- The high costs or poor quality of public services; costly and wasteful extensions of or lack of sewer, water, gas and electric services; similar wastful costs of or inadequate transportation, educational, fire, police and other community services.
- Unregulated growth of poor quality rural subdivisions and trailer courts in areas where public agencies are not prepared or able to regulate decent subdivision, housing, building and health codes.
- Waste of land resources in bypassed areas suitable for no economically productive use, either for housing, industry or farming, nor for public recreation.
- Monotony, lack of community identity and inadequate social and cultural opportunities.

Problems of Established Communities

The following is a list of major problems facing many established communities. They appear to stem in large part from lack of sufficient municipal revenues, overcompetitiveness in the exercise of local powers, lack of mechanisms for dealing with problems that do not recognize jurisdiction boundaries (regional problems), and inability to forecast and act on emerging issues.

1. Deterioration of older residential neighborhoods with subsequent loss of tax base, loss of purchasing power, social and economic segregation and need for increased health, welfare and safety services.

2. Lack of community facilities such as park and recreation areas where they are needed and public transportation facilities to serve the needs of the young, aged and poor.

3. Deterioration of central industrial and commercial districts with resultant erosion of tax base because of competition from new outlying areas.

4. Exclusionary zoning practices on the part of some communities for the purpose of social control and protection of property values resulting in forcing the poor and minorities into older sections.

5. Proliferation of special improvement districts for a multitude of single purposes. These districts operate without coordination, each with its own taxing power and administrative mechanisms. They are not publicly "visible" or responsive and frequently outlive their original purpose because there is no public check on their usefulness.

Land Development Practices

The development process has four general phases: programming (planning), design, construction, and maintenance. From a policy standpoint, the programming phase is the most important because that is where locational decisions are made. In general, economics takes precedence in this phase, but political-legal constraints such as deed restrictions, zoning, building and subdivision codes, and varying taxes have been effective in directing and timing growth as well. If new objectives could be agreed upon, and if these could be translated into new policy levels, our old political-legal institutions could be improved upon and new ones developed to help both public and private sectors structure better communities.

Private Sector

The private development sector initiates and carries out the bulk of our urbanization in thousands of relatively independent actions. It has an enormous capacity for discovering opportunities for profitable effort. Its goal is legitimately and necessarily making profits, but while profits are essential, the profit motive has provided the basis for a simplistic measurement of values.

In this system, the cost-benefit analysis and the making of money have resulted in a distortion of values wherein we have allowed profit making to become equated with social benefit. As a result, there are great efforts being made to translate social costs and benefits into dollar terms to help measure the real impact of alternative developments.

The hue and cry for social considerations comes from one sector, while others call for increased concern for aesthetics, others call for increased concern for natural factors, and others point out the need to be concerned with economic, political and legal factors. Arising from the need for comprehensive understanding of all issues, it has become obvious to many development companies, industries, and government agencies that an "interdisciplinary approach" should be used in solving complex problems.

The "interdisciplinary approach" brings to bear on the planning and design of a project--whether it be an industry, freeway or community--the knowledge and skills necessary to assure that the planned results meet the cross section of needs of its time, place and purpose. Almost any project has both local and regional impact and should be inspected from these aspects. Once considered the exclusive bailiwick of the engineer, the urban freeway now also employs in its planning and design: planners, sociologists, economists, architects and landscape architects. A community development plan can employ planners, lawyers, sociologists, foresters, zoologists, geologists, hydrologists and economists in addition to experts in architectural and landscape design and a host of engineering specialists, to name but a few.

This approach to planning is becoming "standard" with state highway commissions, advanced land developers, large industries and federal agencies. It is the only way to insure that all important phases of a problem will receive the attention they deserve and that the final solution will be affected by consideration of them.

The general factors requiring attention in any project of major importance can be briefly listed.

1. Social-cultural
2. Political-legal
3. Economic--that is, the economic feasibility of the development itself as well as the public costs and benefits
4. Natural--air, water, land, fish and wildlife
5. Physical--man-made factors such as existing structures, systems and services
6. Aesthetic--mass,form, color and texture.

Each of these factors has within it sub-factors generally known only to experts in their fields. It is almost impossible for one administrator to know which considerations should be studied in depth because of their importance to the project and which can be set aside as relatively unrelated. This is why it is so important to get a broad perspective of all facets at the beginning of planning. A legislative mandate requiring an interdisciplinary approach to urban development and review processes would go far toward changing the face of urban environments.

Public Sector

Federal, state and local agencies, as well as the private sector, initiate and finance enormous amounts of construction. The public sector plays two roles, that of developer and that of controller of private development.

In the role of developer, all public agencies should be subject to the same disciplinary methods as the private sector. In fact, they should play leading roles that the private sector would emulate. The National Environmental Policy Act of 1969 requires that federal agencies "utilize a systematic, interdisciplinary approach."

State governments should do no less; but they, as well as the federal and local levels, also have other opportunities. One of these is to use investment programs to guide better development. The State, for instance, is involved in an investment program including state highways and transportation, urban arterials, public schools, colleges and universities, sewer lines and treatment plants, state parks and recreation lands, local facilities and open space, institutions, land reclamation, airport subsidy, trust lands, bridges and ferries, and nuclear siting.

Obviously all of these expenditures have land-use implications, but rarely, if ever, are these programs administered with concern for coordinated land use as such. The State should develop an urbanization policy as a good business practice so that state investments are used to assist in directing more orderly development, rather than following the uncoordinated development we now have.

By the Tenth Amendment to the Constitution, States have authority for management of state and private lands within their territory. However, they have distributed much of this responsibility to city and county governments in the form of powers for planning and zoning so that land-use decisions are made in the localities affected by them.

In the last few decades a very large gap has appeared in this land-use control mechanism with respect to multijurisdictional issues that do not coincide with city and county boundaries. Decisions of small communities adversely affect the environment, economies and social conditions of entire regions and no way has been found to deal with them effectively. The solution to this problem requires that the State realign its development planning and control mechanisms and those of city and county governments. This realignment appears to require the State to increase its policy-making role and provide higher standards for public agencies' performance.

Areas of Critical Concern

State government should take the responsibility for identifying areas of critical concern and monitoring land uses within them.

Specifically, the State should develop:

* An overall land-use policy and plan for environmental preservation and resource conservation including the living natural systems and state-owned lands, uplands, forests, watersheds, shorelands, arid lands, agricultural lands, geologically or otherwise unique areas, water-use and development, air quality and mineral development.

* An urbanization policy and plan covering areas of state investment and grants-in-aid.

* Performance standards and guidelines for local government of delegated responsibilities for land-use planning and control.

* A method for coordination and review of local plans and development legislation to insure that they relate to state and regional goals.

Planning, Design and Review

In the land and water areas of critical concern, land-use guidelines covering development principles should be developed by the State. These should be administered by the local government having jurisdiction over the particular area of concern under methods to be designated by the State. In order to surmount the inflexibility of present zoning techniques, it is proposed that land developers, local regulatory agencies and state government be involved in a comprehensive planning, design and review system. The interdisciplinary approach previously discussed should be made a mandatory part of the system at both planning and review phases.

Once areas of critical concern are identified by the State, these concerns and land-use guidelines would be forwarded to local governments. Counties and cities of jurisdiction would prepare plans and regulations within a set time period. These would be reviewed, approved or rejected by the State as dictated by state objectives. Once plans and regulations are approved, local government would administer all land uses, except extraordinary ones. Extraordinary land-use proposals would have to receive both local government and state approval since they would not be covered by the original plan.

In the case of state projects it is recommended that local government act in areas of critical concern in an advisory capacity to the State.

Technical assistance and financial support to local governments should be a part of the new planning, design and review process in order to assist in the extra-administrative operations required as well as in various other ways that may be necessary to make the new control mechanisms more effective.

A State Policy

State land use policy might be defined in the following terms:

1. The social and economic well-being of the people of the State is closely related to the condition of the environment and to resource management. It is therefore urgent, in the face of rapidly increasing demands on the environment, that the State develop a land use policy for protection of the environment and conservation of its resources, and develop an urbanization policy related to it.

2. The people of the State have a fundamental interest in the orderly development of the entire State consistent with the protection and enhancement of its natural land, air and water resources. Therefore, there should be a legislative declaration of state environmental policy modeled after the National Environmental Policy Act of 1969. Such policy should require state and state-chartered agencies to conform to the standards established to effectively, with proper monitoring, head all agencies in the same direction and to unify federal and state policy.

3. Although state government has constitutional authority and responsibility to manage its land resources, it should be its policy to depend upon local government and private landowners to exercise state objectives toward preservation and conservation of land resources insofar as is possible, and the State should assist local government and private landowners in the pursuit of these objectives.

4. Each level of government should be responsible for those areas under its jurisdiction which are primarily the concern of its own citizens. In areas of concern to citizens of multi-city or multi-county jurisdictions, or the State at large, the State should take the primary responsibility unless the cities and counties do so under joint powers agreements. In order for there to be a consistent policy and direction, the State should provide guidance, authority where needed, and financial assistance to help overcome local deficiencies and disparities.

5. At the earliest possible moment, state, county and city governments should identify areas to be preserved and take positive actions toward preserving them in accordance with local objectives and state policy.

6. The actions of all agencies, in order to be consistent with these objectives, should be subject to statewide review and coordinating procedures.

7. It should be the policy of state government to take direct remedial action when local government and private landowners are powerless or reluctant to act in behalf of objectives.

8. State and local tax policies should be designed to support these environmental protection and resource conservation objectives.

Legislative Alternatives

The following alternatives demonstrate directions that might be taken. The first alternative is little more than doing as we always have. The last three alternatives propose to insert state or regional policy-making into land use decision processes more than in the past, but in varying degrees. All alternatives depend upon local government taking increased land use planning and control responsibilities and all alternatives could be modified to contain certain elements of the others.

Alternate I: Information and Individual Issues

This alternate presents the possibility of continuing to act on one issue at a time in a relatively unrelated way.

There is no doubt that there are many important issues competing for legislative action. All those listed will meet some requirement and, even if more comprehensive legislation is adopted, some would still be desirable for their stated purposes.

--An extensive inventory and research program into the actual extent and scope of environmental deterioration and future needs should be undertaken. This would draw attention on areas not now known and would lead to solutions based upon more knowledge than now exists. However, it would be prudent to combine this level of research with an action program so that it does not go to waste.

--There appears to be a need for better special district and local agency formation control and review of need for continued existence.

--A number of beneficial improvements should be made to assist local government in exercising its present zoning ordinances, such as (a) compensable regulations, (b) a provision that local governments could enter into development contracts with private owners in "planned development zones," and (c) a provision permitting local government to charge for up-zoning (English method).

--Mandatory dedication of park, open space and school sites or the payment of in-lieu fees to help resolve local agencies' fiscal needs should be required.

--Provision should be made for use of the "official map" technique for open space and other public facilities space acquisitions.

--A requirement should stipulate that local governments include conservations and open space elements in their general plans.

--Provision should be made for a state or regional development agency to buy, plan and sell land to developers so as to control the location, timing and development of it.

--A significant emergency rotating fund should be established to buy already impacted areas and otherwise assist local government in exercising land-use controls through compensable regulations.

--Adjustment of tax programs should be undertaken to provide more equity among local agencies.

Alternate II: State or Regional Review

Place new responsibilities for land-use planning and control on local governments together with a new state [or regional] review [or approval] system.

As can be seen by the above use of brackets this proposal contains some interior alternatives of its own.

The State (or the State together with regional agencies that might be established in the same legislation) should establish state and regional objectives, policies, priorities and guidelines for local governments' use in preparing conservation and development plans which would be new mandatory elements of their general plans. They would be given a deadline for completing these plans. If they could not or chose not to prepare the plans for themselves, the state or regional agency could be authorized to prepare the plans for them.

The plans prepared by the local agencies would then be submitted to the state or regional planning agency for review and approval, request for modification, or rejection if unsuitable. Two alternative courses lie open at this point.

Alternate A. It would be possible to give the regional or the state agency only an advisory and persuasive role in which case the state or regional agency could only recommend to local governments. This power to recommend could have considerable influence, particularly if the regional or state agency is required to evaluate and make recommendations to federal and state agencies being petitioned for aid funds.

Alternate B. The state or regional agency could be given very strong powers for review and approval of plans and implementation programs. In this case, in the absence of an approved plan, the local agency would not be eligible for state or federal grant funds or loans related to the elements of the conservation and development plan.

Implementation of the plan in either of the above cases would be entirely in the hands of the local agency. However, deviations from its requirements would be by special permit only. Special permits would have to receive the approval of the local and review agencies where the state or regional agency had been given strong review powers.

Alternate III: State Guidelines

Require the State to establish areas of critical concern together with guidelines for land uses within them. Local government to plan and administer land uses in areas of critical concern but plans to be subject to a state review system before becoming effective.

In this case the State would prepare plans and policies showing areas of critical concern (dealt with in more detail elsewhere). The reasons for, and guidelines governing the kinds of land uses permitted in, the various areas of critical concern would be forwarded to the local government. Plans and development regulations would be prepared by the local government having jurisdiction. The plans and regulations would then be forwarded to the State for approval or modification. Once they were approved, local governments would administer land uses in the areas of critical concern in compliance with the regulations applying to them. Any unusual developments not covered by the plans would be treated as special permits and would require the State's approval. All applications including those of special districts for development within the areas of critical concern would be processed by the local government having territorial jurisdiction. No development permits would be issued until the state review body approval was received by the local government and no state agency could take any action within the area of critical concern unless the state review body approval was given.

It is recommended that the state review body consist of the Governor and principal agency administrators. The Governor, with agency support, would define the areas of critical concern and guidelines.

Alternate IV: State Land-Use Commission

A proposal to establish a State Land-Use Commission which would designate settlement, conservation and agricultural districts.

This alternative is to establish a Land-Use Commission much along the lines of that established by Hawaii about ten years ago. Because the Hawaii system would have certain shortcomings in some States with a much more complicated system of government, certain differences can be recommended. Basically these would be (1) to establish a state land development and settlement policy as a basis for planning and districting, (2) to provide for a different number of districts than the four in the State of Hawaii, (3) to simplify the administrative procedures, and (4) to provide for yearly review.

This is a statewide zoning system based upon a state "plan" which would be updated yearly in accordance with a review and with policy changes that may be enunciated by the Governor. The State Land-Use Commission would develop regulations governing land uses within the conservation and agriculture districts. Local government would retain its land-use regulatory powers within the settlement districts and would administer land uses within the conservation and agriculture districts on a special permit basis subject to State Land-Use Commission approval. (This is different from Hawaii where the State Department of Land and Natural Resources regulates land uses within the Conservation District.)

The Hawaii system has acted as a restraint on leapfrogging and scatteration and thus has provided protection to its important agricultural districts and natural and scenic resources.

This is an excellent state land-use control mechanism. It has an advantage in having been successfully tested. Although in Hawaii it has certain built-in problems that are difficult to change, it can be observed in operation and improved upon for other States' applications. The review processes, regional planning and other concepts herein discussed under separate sections could all be included in a comprehensive Land-Use Law along these lines.

There is also the possibility of avoiding the lay commission aspect by having the Governor and principal department heads act instead.

Summary

Almost constant conflict exists between urban development and conservation principles. The profit goals of private enterprise and the requirements for economy placed on public agencies have caused developments of all kinds to take an unnecessarily contradictory position toward environmental preservation and enhancement.

Municipal and county governments make land-use decisions adversely affecting areas far beyond their borders because no other mechanisms exist for making these decisions. They also find themselves unable to be fully objective because, under the present tax laws, revenues from property taxes accruing from development are essential to their fiscal well-being.

The use of land as a relatively unregulated commodity, the desires of owners to realize maximum economic benefit from its sale, use or development, and the economic penalties if they do not, generate intense demands on land resources. The dilemmas caused by these problems and the lack of mechanisms for adequately dealing with them have resulted in serious environmental deterioration with prospects for continuation if remedies are not forthcoming.

Because cities and counties receive their authority from state government, studies conducted throughout the Nation are calling for States to develop urbanization policies giving priority to conservation, social and aesthetic requirements. Public reaction to air and water pollution has resulted in legislative action to correct those problems. The next targets are the problems connected with environmental deterioration related to uncoordinated, ill-conceived, poorly planned and wasteful land-use practices.

While more equitable public financing methods will go far toward mollifying the problems of established communities, and while a change in public attitudes toward land ownership may make land-use controls easier to accommodate, most urban developments fail because they are shortsightedly measured only in economic terms. They are, therefore, incapable of fulfilling social, aesthetic and natural needs no matter what reforms might be made in the tax and landownership patterns.

For these reasons, a comprehensive, inter-disciplinary approach to planning, design and review of developments should be required of all public and private builders. This approach is already gaining favor among the private sector, has been used successfully many times by public agencies, and is required of all federal agencies under the Environmental Policy Act of 1969. Such an approach by the State Legislature would make it mandatory to consider social, legal, economic, natural and aesthetic factors in the planning and review of public works and developments.

State government's goal, therefore, should be to develop urbanization policies and programs that take into account both people's and nature's needs for the purpose of minimizing the areas of conflict and discovering and enhancing the areas of harmony.

Toward a State Land Use Policy, The Maine Experience

Philip M. Savage

The State of Maine, at least in the area of state level land use legislation, is one of the leading states in the "Quiet Revolution in Land Use Control." This Revolution includes three major pieces of legislation passed and expanded during a two year period, 1970 and 1971.

First is the Site Selection Bill passed by the Special Session of the 104th Maine Legislature early in 1970 and amended in 1971. The Site Selection Bill now requires a license for any commercial, residential or industrial development which occupies a land area in excess of 20 acres, or which contemplates drilling for or excavating natural resources, or which occupies on a single parcel a structure or structures in excess of a ground area of 60,000 square feet.

The Act is administered by the state's new Department of Environmental Protection which applies the following four criteria to any proposal covered under this Act:

1. *Financial capacity.* The proposed development has the financial capacity and technical ability to meet state air and water pollution control standards, has made adequate provision for solid waste disposal, the control of offensive odors, and the securing and maintenance of sufficient and healthful water supplies.

2. *Traffic movement.* The proposed development has made adequate provision for loading, parking and traffic movement from the development area onto public roads.

3. *No adverse affect on natural environment.* The proposed development has made adequate provision for fitting itself harmoniously into the existing natural environment and will not adversely affect existing uses, scenic character, natural resources or property values in the municipality or in adjoining municipalities.

4. *Soil types.* The proposed development will be built on soil types which are suitable to the nature of the undertaking.

Two Acts passed in June 1971 are a bill providing for State Level Land Use Controls-the Mandatory Zoning and Subdivision Control for Shoreland Areas, and an Act extending the jurisdiction of the Maine Land Use Regulation Commission.

The Act revising the Maine Land Use Regulation Commission extends planning, zoning and subdivision controls to all unorganized and deorganized areas of the state except Indian Reservations. The total area under jurisdiction of this Commission is 51% of the state's land area. The seven-man commission, of which I am secretary as State Planning Director, will classify lands into protection, management, development and holding districts.

We are now in the process of setting standards for determining the districts; we also may subdivide the major districts and establish regulations and land use guidance standards for each district. An interesting provision of the law provides that if an

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This paper was originally presented at the Confer-In '72, American Institute of Planners Annual Conference, Boston, Massachusetts, October 8, 1972.

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area becomes organized or incorporated as a municipality it continues to be regulated by the existing standards until new regulations not less protective than the existing regulations are enacted. The boundaries and regulations can be amended, public hearings are provided for, and a comprehensive review of the districts will be made every five years. All development requires Commission review and approval except those approved by the Department of Environmental Protection under the Site Selection Act.

The main purpose of the Mandatory Zoning and Subdivision Control Act is stated as follows:

"To aid in the fulfillment of the state's role as trustee of its navigable waters and to promote public health, safety and the general welfare, it is declared to be in the public interest that shoreland areas defined as those land areas any part of which are within 250 feet of the normal high water mark of any navigable pond, lake, river or salt water body be subjected to zoning and subdivision controls. The purposes of such controls shall be to further the maintenance of safe and healthful conditions; prevent and control water pollution; protect spawning grounds, fish, aquatic life, bird and other wildlife habitat; control building sites, placement of structures and land uses; and conserve shore cover, visual as well as actual points of access to inland and coastal waters and natural beauty.

"If any municipality fails to adopt zoning and subdivision control ordinances for shoreland areas as defined in section 4811 by June 30, 1973 or if the Department of Environmental Protection and the Maine Land Use Regulation Commission determine that particular municipal ordinances because of their laxity and permissiveness fail to accomplish the purposes outlined in section 4811, the Department of Environmental Protection and the Maine Land Use Regulation Commission, shall, following consultation with the State Planning Office with respect to these shoreland areas, adopt suitable ordinances for these municipalities, which ordinances the respective municipalities shall then administer and enforce.

"The Department of Environmental Protection, the Maine Land Use Regulation Commission, municipalities and all state agencies shall mutually cooperate to accomplish the objectives of this chapter. To that end, these commissions shall consult with the governing bodies of municipalities and to whatever extent necessary with other state agencies to secure voluntary uniformity of regulations, so far as practicable, and shall extend all possible assistance therefor."

As a result of these three major pieces of state legislation, the State of Maine now has great authority for the control of land use. As policy statements, they indicate that the state will assume final and complete authority for the guidance and control of the use of land and water within its boundaries. I should also add that in my view we are not properly organized or funded to adequately carry out these responsibilities. Furthermore, we do not have a comprehensive state land use plan which should guide the implementation of these Acts, and our first task is to establish a complete and definitive policy for land and water use in the state.

A Subcommittee of the Governor's new Cabinet, including all Commissioners and staff assistants from the Governor's Office with major interests in the use of land, was established at a Cabinet meeting on May 26, 1972. The purpose of this Committee will be to develop and maintain a comprehensive policy for land and water use throughout the state.

The State Planning Office serves as staff assistant to the Subcommittee to provide assistance on the first task which will be to identify and define the many ongoing activities related to land and water use in the state. These activities will be brought together and related in a series of major policy statements that will serve as a guide to consistent, coordinated and rational public and private decisions in the use, regulation and development of land in Maine. . . .

There is an urgent need to bring together the many ongoing studies and activities such as the present work of the Public Lands Committee, the Governor's Task Force on Energy, Heavy Industry and the Maine Coast, taxation of land, the activities and programs of local and regional planning commissions, and the development aspects of land, such as a proposed Maine Land Development Authority, so that these activities will not conflict or duplicate and will work together in the same direction.

This work is especially timely in that a major federal bill on state level land use controls is expected to be passed at this session of Congress. The bills would place responsibility for implementation of land use policy on the state, with provision for delegation of responsibilities to regional and local government agencies.

The definition and implementation of land and water use policy will attempt to deal in a more comprehensive and systematic way with the many and varied problems of conservation, economic development, regulation and pollution by providing a better informational base for both public and private investment decisions. It will define relationships, identify problems and purposes, and alternative programs aimed at providing the greatest long-term benefits for all the people in the state.

A major objective of this Subcommittee and state policy will be to resolve the present paralyzing economic versus environmental crisis. This crisis indicates an urgent need for the state through its policy-making mechanism to develop information, criteria and procedures to resolve the constant conflicts that arise between the need for economic growth and development processes on the one hand, and the equally important need for environmental preservation and resource conservation on the other.

Elements of a State Land Use Policy

In formulating an acceptable policy for the State of Maine on land use management and programs, we should begin by asking ourselves what state actions to improve and regulate land use would be acceptable in light of the current attitudes and behavior of Maine people. Do enough Maine people really want improved land use management when such programs will involve expert instead of individual judgment? And, when such programs will mean the substitution of collective goals in place of individual judgments?

Most residents of Maine have exhibited a low tolerance for bureaucracy and centralized regulations, whether in large-scale government programs or other large-scale activities such as the State University system. In light of the fact that over four hundred units of local government in Maine still lack effective land use management controls at the local level, they also seem to resist collective action at the local level. Nevertheless, the people of Maine through action of the last two sessions of the Maine Legislature have authorized three major pieces of state level land use regulation. . . . Although it is difficult to speculate on future attitudes, it seems safe to assume that if some of our present bureaucratic structures would become less bureaucratic and less centralized the people of Maine would be more willing to accept certain kinds of central planning and collective judgments on the control of land in this state.

An acceptable state policy and program for land use control should be decentralized and as simple and direct as possible so that it will be easier for Maine people to adjust both their attitudes and behavior to these new conditions. But if bureaucratic structures become more instrusive in their everday lives, if there are more restrictions and more delays in getting things done, Maine citizens will probably have a negative reaction by rejecting such controls and try to hold on more tightly to what they believe are their last few remaining areas of privacy and individual freedom. They obviously prefer to keep local government decisions close to themselves and will oppose distant sanctions or centralized coercion.

Although the increased state concern with the consequences of development is urgently needed, it is vitally important to channel this concern into areas where it will be effective in dealing with important problems without unnecessarily increasing the cost or time in the land development process. A time-consuming and inefficient procedure requiring the approval of many state or federal agencies for land use decisions of minor importance could have serious social and political consequences.

For this reason it is important to recognize that a great number of the land use decisions that should be made by Maine local governments have no major effect on state, regional or national interests. Furthermore, most of these decisions can be made intelligently only by people familiar with the local social, environmental and economic conditions. The decision on the use of a small parcel of land located at the corner of Main and Elm Streets in Waterville can only be made intelligently in Waterville, not in Augusta or in Washington.

The first task is to balance the need for expanded state participation in the control of land use with the objective of limiting this participation to those land use decisions which involve only state or regional interests while retaining local control over the smaller, community issues of only local concern. The problem of defining state interests and local interests is not an easy one, but it has been done in the Site Selection Act, the Mandatory Shoreline Zoning and Subdivision Act and the extension of the jurisdiction and powers of the Maine Land Use Regulation Commission. These legislative acts authorize the state to control certain large-scale developments, to manage a critical area and to protect an uncontrolled area.

The first major element in a state land use policy, on the basis of recent experience, is that the State government should take the responsibility for identifying areas of critical concern and to regulate those areas in the public interest. To identify such areas, the state may establish four guidelines for the selection of such areas:

First, the state may designate portions of the state which because of their natural resources characteristics or other considerations become areas of statewide concern. The shoreline areas of the Mandatory Zoning and Subdivision Act of 1971, wetlands, an area surrounding a major highway interchange and approaches to major airports are examples of areas of state concern.

Second, some types of development may have only local impact if undertaken on a small scale, but may be of state or regional significance when undertaken on a large scale. This applies to commercial, residential and industrial development of large size as specified in the Site Selection Act.

Third, some types of development by their very nature and impact almost invariably become matters of state or regional concern. This would include major airports, public utility transmission lines, power plants and major highways.

Fourth, areas that cannot be supervised or controlled by local governments or other regulatory authorities must become the responsibility of the state. The planning, zoning and subdivision controls over the unorganized and deorganized areas of the state by the Maine Land Use Regulation Commission is an example of this type of situation. This may also include areas where local governments refuse or are unable to act over a certain period of time in the organized areas.

The second major element in the State Land Use Policy is the need to formulate and implement policy and programs for the urban areas and local communities of Maine. An essential element of this policy is that areawide, regional planning serve as a framework for local government activities. The manageable aspects of our environment and economy now come in regional packages. Furthermore, in a state as large and diverse as Maine, regional planning agencies are better able to respond to sectional peculiarities necessary for the development, acceptance and implementation of water and land use plans.

This regional approach was made official by order of Governor Curtis on January 26, 1972, when he issued an Executive Order establishing a system of official planning and development districts for the entire state. The eight major drainage basins in Maine served as the framework for the designation of the districts. Effective land and water use planning was the major criteria used in delineating the boundaries of these districts; they are large in size but small in number so that they can deal with and coordinate the many issues and relationships involved in proper land management.

The success of the river basin approach, while not utilized extensively in this nation, is apparent in many European situations such as the Ruhr Valley. It has the ecologically sensitive total land use view of a drainage system in that it allows for a comprehensive approach to environmental degradation from all sources rather than the usual approach of a site-by-site abatement program.

The estuaries of our state, where the complicated interactions between fresh and salt water occur, are prime examples where the regional implications -- defined as watershed areas -- are especially noticeable. If the estuaries of Maine are to be reestablished and maintained as something more than open sewers, effective planning and programs must provide for the management of entire watersheds.

Environmental, economic, social and political problems are so interrelated in the design and implementation of land use controls that we must integrate the functional with the geographic and administrative aspects of government on a consistent area basis. The proliferation of land development review and approval bodies at the local government level will increase both construction and government costs. The long run objective of a well-planned, livable environment requires that planning and project review be carried out on a regional basis.

We must, in the future, avoid the growth and multiplication of a great number of conflicting and overlapping special agencies, boards or commissions to handle in isolation one problem after another and in the end seriously diminish our capacity to deal with complete ecosystems in a coordinated, comprehensive and continuing manner.

This policy should also clearly define the local decisions that will be left to local communities based on information developed in consultation and cooperation with communities in Maine. The state may explore the option of developing a temporary system of land controls for these communities not ready or willing to exercise such controls until such time as local controls are enacted or brought up to state standards.

Technical assistance and financial support to the regions and local units must be expanded to have a workable program. Much of this additional support may become available from the state level land use bills introduced to both Houses of the 92nd Congress in 1971 and expected to pass this year. All bills would place responsibility for implementation on the states with provision for delegation of some responsibilities to regional agencies and local governments. There are also explicit or implied requirements in all bills for methods for inventorying, designating and exercising state control over critical areas.

It should be the policy of the state government to take direct, remedial action when local government and private landowners are powerless or reluctant to act in the interests of land management. So that there be consistent policy and direction, the state should provide guidance, authority when needed, and financial assistance to help overcome local deficiencies and disparities.

The third major element is the need to establish clear and coordinated policy, performance standards and criteria at the state level for the guidance of state, federal and local governments and private developers for effective implementation and coordinated land use planning and control.

The State of Maine may want to consider its own version of the landmark National Environmental Policy Act of 1969 to provide a general declaration of land use control and environmental policy and establish general criteria now scattered and fragmented among many state agencies, and add the definition of critical areas described in the first element of land use policy.

The development of more sophisticated impact statements at the state level can serve to assemble all relevant technical information, discover potentially irreversible effects, help evaluate planning alternatives and define public concerns. It is an extremely valuable evaluation tool and, if used in conjunction with overall land and water use planning, individual projects could be implemented with more complete knowledge of their long-term effects.

The only analysis that existed before the advent of environmental impact statements was the practice of assessing dollar values as the sole basis of weighing or justifying all elements in a complex situation, the cost-benefit analysis. The limitations of this approach are now widely recognized in that they attempt to force all elements of a resource situation into a dollar framework. Such calculations have been generally used to justify a choice made rather than to determine which choice is best.

It is desirable for the state to coordinate and integrate much of the major existing laws, add new policy and criteria to provide in one law and policy the guidelines for state and local agencies. Such law and policy would require all state and local agencies to conform to the policy and standards to effectively head all agencies in the same direction and to unify federal, state and local policy on land use. Each regional agency could also determine more specifically refined standards, based upon minimum requirements and guidelines prepared at the state level for application within that particular region.

The fourth major element is a method of review and coordination of land acquisition plans and proposals of all state agencies. The recent work of the new Interdepartmental Committee on Public Lands and other recent developments points out the need for more effective coordination of land acquisition programs within state government. This could be accomplished by expanding the present project notification and review system carried out under the A-95 procedure. It would briefly provide a central clearinghouse for: (A) all land holdings of state agencies, and (B) all land acquisition proposals of state agencies. Like the A-95 process, approval or recommendations of the clearinghouse and other relevant state agencies, plus conformance to state land policy, standards or criteria would be a prerequisite for land acquisition or disposal by the state.

In addition to federal projects, state projects should also be added to the A-95 review process to aid in the coordination of the state public improvements program and also set up a method to assess their overall impact on state land use, their environmental impact and economic consequences.

The fifth element in a state land use policy is to encourage the use of taxation at both the state and local level to reinforce and support land management goals and objectives. In general, this means that the state and local tax system should support the highest and best use of land as defined in state policy, laws, standards and criteria. In 1965, for example, the Hawaii legislature applied a tax deferral technique by allowing tax exemptions on land in their urban zones dedicated for open space, public recreation and landscaping. The negative effect of the property tax on land use and development in all communities is well known.

It is expected that this element will be a major concern of the seven-member special committee now studying Maine's tax structure. It is a major concern of the present study now being conducted by the Governor's Office on alternative methods of state financing and state revenue.

The sixth element in a state land use policy is that of providing up-to-date institutions and organizations to effectively plan and control water and land use in the state. The State Planning Office has in the last three years been developing a state planning and management system which attempts to provide for the participation of those affected for continuous planning so that plans may be revised and updated and for coordination so that all components are properly related at four levels of planning--federal, state, regional and local.

This system includes the following four major components: (1) state government reorganization; (2) official planning and development districts; (3) a state comprehensive policies plan; (4) a state information system.

None of the four components are completely developed. Early in March 1972 a Special Session of the 106th Maine Legislature approved 10 out of 13 proposals for new departments. Although the establishment of ten new major departments is a significant and unprecedented accomplishment, it did not deal effectively with the major environmental and natural resource functions of the state.

The continued fragmentation of functions and scattering of responsibilities in these areas makes it difficult--if not impossible--for the chief elected official of this state and the legislature to develop a comprehensive strategy and launch a coordinated attack on the complex problems in these vital functions of state responsibility.

Many agencies in these areas will continue to represent narrow, parochial interests. One agency may easily duplicate the work of another or all may work at cross purposes. The Governor will continue to devote a substantial part of his valuable time to resolving conflicts and dealing with details that these department heads could handle themselves if the Executive Branch were better organized.

In constructing a model for such institutions and organizations, we must avoid giving overall land and water use planning to agencies with a narrow mission or built-in bias. We should also learn from the experience of federal agencies with this problem. The following statement by Charles R. Goldman, Director of Environmental Studies, University of California, summarizes the views of most qualified observers on this issue:

"Since the two major federal agencies responsible for planning water developments are also responsible for construction (the Corps of Engineers and the Bureau of Reclamation), it is unreasonable to expect them as a general practice to consider alternatives which would mean non-development. Further, it is unlikely that their plans necessarily reflect a wide range of interests. At the same time, despite current enthusiasm, the environmental interests are still not really well enough organized nor well enough financed to undertake their own studies of large water projects.

"It is uncertain whether new governmental agencies such as the Environmental Protection Agency and the Water Resources Council can effectively represent the range of environmental interests. There can be no doubt that governmental agencies at all levels are earnestly attempting to accommodate environmental interests in their planning. Fox [Professor Irving K. Fox, University of British Columbia] believes that this 'in house' process of developing a concensus might leave the more committed environmental groups embittered and the decision-making process at a stalemate. He concludes that the federal government should have a separate environmental Resource Planning Agency which would actually take the lead in developing regional environmental resource plans. . . . In such an organization it would be wise to include such resource agencies as the U. S. Fish and Wildlife Service who have a clear environmental involvement but not such developmental and construction agencies as the Bureau of Reclamation and the Corps of Engineers. Finally, it would be unwise for such an agency to possess any regulatory responsibility."

Comprehensive, overall planning for state water and land use should not, therefore, be located in a promotional, construction or regulatory agency.

Both water and land use planning and policy are essential as a guide for long-term regulatory activities. This was pointed out in a recent comprehensive report on innovative land use laws and programs of several states for the Council on Environmental Quality. In this report, "The Quiet Revolution in Land Use Control" by Bosselman and Callies, the following paragraph completed their analysis of Maine's site location laws:

"In the long run the Site Location Law may be seen as more of a stopgap remedy than a permanent solution. The absence of any overall state planning process that provides a rational basis for regulation, and the reliance on clearly inadequate criteria for decision-making, must eventually weaken the program's effectiveness. The major question for the future is whether the state can expand the Site Location Law into a more comprehensive land regulatory system that leaves the local issues to local governments but deals with major development proposals in the framework of a broader conception of state planning than the current law contains."

In a broader sense, the need for a state land use policy also grows out of an increasing awareness of the many interrelated issues, activities and problems that confront this state. No doubt other concerns in addition to the elements listed here should be included as we proceed to provide a framework within which urban and rural development and the quality of our environment can be assessed. To provide proper perspective a state land use policy is not just a natural resource policy, it must also be concerned with the problems of economic growth, the provision of public services and regulation at all levels of government, the allocation of public resources and the very structure of our federal system of government.

Historically, the control of land has been a local function in our federal system of government, but in recent years local units have been unable to deal with large-scale projects or handle involved proposals which require expertise more likely to be available at the state levels.

All the legislative proposals being considered by Congress recognize this trend. It now seems that there will be some form of federal land use bill and the responsibility for implementation will be on the states. State governments will be called upon to assume new responsibilities in land use management. Because of these developments, Maine must be prepared to use this opportunity and accept responsibilities for the management of its water and land resources.

Applications

Conservation is a state of harmony between man and land.

Aldo Leopold

Incentives and Controls for Open Space

Ann Louise Strong

Regulation as Distinguished from Zoning and Subdivision Controls

Within the open space framework, zoning and subdivision controls are regulation, but not all regulation is zoning or subdivision control. Since the distinction between the terms leads to differences in their applicability, it is important to define them carefully at the outset and to state that they will be used as defined throughout this chapter.

Regulation is defined as uncompensated control of activities for the public health, safety, morals, and welfare; in this context it is control of land use for open space purposes. Zoning and subdivision controls are defined as one form of regulation, included within the overall definition but with two qualifications: (1) they encompass the entire geographic area of the enacting unit of government, and (2) the public for whose benefit they are enacted are the residents of that unit of government, not people at large. Regulation of the flood plain of a stream throughout its course, enacted for the benefit of people at large, irrespective of their place of residence, would not be termed zoning under this definition.

The distinction made here is of importance in order to clarify the limitations in the grant of zoning and subdivision control powers to local governments. For instance, it would be improper for a local government, acting under zoning powers, to prohibit cutting and development of forest land on the ground that increased runoff would add to flood damages of an entire watershed. Similarly, the local government would lack authority to prohibit development of an aquifer recharge area for the purpose of maximizing the quantity of flow to an aquifer serving a nearby metropolitan area. These regulatory powers might be specifically delegated by a state, possibly to local governments, but more probably and more logically to a regional public agency charged with resource management.

State Regulatory Power Is Possible

The states have broad powers to regulate man's use of his resources. Power to regulate through use of zoning and subdivision controls customarily has been granted by the states to local governments and has been widely used by them, in part for resource objectives. The retained power of the state to use zoning and subdivision controls often has been neglected. In fact, to date, only Hawaii has chosen to exercise the state zoning power. Other regulatory powers granted by the states to local governments are restricted to protection of persons within the boundaries of the local government. It remains for the states to employ their general regulatory power to control use of resource areas for the benefit of the public at large, not just the public in the areas regulated.

This article, extracted from "Incentives and Controls for Open Space," originally appeared in Metropolitan Open Space and Natural Process, edited by David A. Wallace (Philadelphia: University of Pennsylvania Press, 1970). Reprint by permission.

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Dedicated Open Space Must Be Directly of Benefit to Users

As an illustration of what has just been said, to be sustained as reasonable, subdivision requirements for the dedication of land for open space or payment of a money equivalent should be tied, for acreage standards, to population density in each subdivision and, for facility standards, to total population in the subdivision. The open space, if not within the subdivision, must be easily accessible to the residents. If too far away, regulations requiring it may be challenged successfully by the developers.

No Taking Without Just Compensation

The above, or any kind of land use regulation, will be held unconstitutional as a taking without just compensation, if it causes too great a drop in the market value of land when applied. Already it is accepted that landowners, through regulation, may be deprived of some portion of their land's value; the need is to quantify and standardize the permissible percent of loss. To date, there has been no presumption of unconstitutionality based on a given percent of loss attributable to regulation. Here it is later proposed, for open land, that all losses in excess of 25 percent attributable to regulation be presumed unconstitutional. Therefore, uncompensated regulation would be used only for land use restrictions causing a drop in market value of 25 percent or less.

While regulations deprive landowners of varying percentages of land value, landowners receiving compensation for land use controls are paid the full value of their loss. For example, zoning might reduce a parcel's value 15 percent, while the owner of a similar parcel, reduced in value 15 percent by a utility line, would be paid the full value of that right-of-way. This is an inconsistency in present public policy that quite possibly should be eliminated so that all landowners subjected to land use controls would bear the same proportionate cost of these public controls. Such an approach is defensible for owners whose land is subject to public less-than-fee interests, but it is arguable that, because of the inconvenience and dispossession accompanying fee acquisition, full loss compensation should continue to accompany fee acquisition.

Validity of Controls over Time

Controls customarily are chosen for their cheapness and efficacy at the time of selection. Regulations, valid when enacted, could become unreasonable because of lack of compensation, and thus invalid, as a result of rising land values. Should an estimate of future rise in value be one factor used in selecting land use controls? Alternatively, should future increase in value be rejected, by law, as a ground for invalidation of controls?

Planning Controls to Establish Assessed Values

Preferential assessment of open space violates the *ad valorem* tax principles included in most state consititutions. If preferential assessment of open space is authorized by law or constitutional amendment, this action weakens the real property tax structure and encourages subsequent breaches in it. Lower taxes on open space can be achieved instead by use of planning controls which restrict land to open space uses and thus cause assessment to be based on land value for these uses only.

A State Capital Gains Tax

A state capital gains tax could be imposed on all land sales in which there had been an increase in intensity of residential use since the last prior sale. Revenues from this tax would be allocated to support of open space land use controls. A capital gains tax of this character would pose a uniformity problem under state constitutions but might be sustained as a reasonable classification for purposes of taxation.

Controls for Open Space

Present powers for open space control are, if properly applied, sufficient for preserving far more open space than has resulted so far. Public concern and support is necessary to increase and enlarge their use. The following discussion of controls for open space is divided into the three major purposes considered earlier: (1) the concern for natural process concentrating on balancing the water regimen; (2) provision of areas, largely coincident with those necessary for (1), but for recreation purposes; and (3) amenity. It is, of course, the hypothesis of the study that these three purposes can all be served best by following the methods outlined in the study.

Controls for Natural Process

Each of the physiographic phenomena distinguished previously is here considered in terms of the nature of the controls required to keep it in a natural or near natural state, and to limit development to varying degrees. Then the most appropriate agencies for such control are suggested.

Controls for Surface Water

Surface water and its adjacent, or riparian, lands and banks should be subject to controls in order to reduce flooding, to regulate the supply, and to maintain flow and quality. Natural flow patterns are frequently altered through construction of dams, reservoirs, and channel works.

Pollution of surface water can be controlled by regulation so as to sustain adequate water quality for domestic and industrial consumption, for healthy fish and shellfish, and for recreation. However, for pollution regulations to be adequate in a densely settled area such as the Philadelphia SMSA, they should be based on basin-wide plans for pollution control. Here, the Delaware River Basin Commission can be expected to develop the plan and to share with other levels of government in its enforcement.

Several units of government, from the Commission to municipalities, plan to construct dams and reservoirs which will minimize flooding and husband the area's water supply. If recreation use of surface water is contemplated, rights of access and shoreline acquisition will be necessary. In some instances, scenic easements protecting the view of water from highways may provide sufficient recreation benefits. Control of riparian lands comes, to some extent, under flood plain control, but not entirely. Where it can be demonstrated that the character of adjacent vegetation and banks are important to the water regimen, shoreline control will also be necessary. It is often this adjacent land that provides the greatest amenity and potential for recreation as well as control of water quality.

Marsh Controls

To fill the resource functions of water storage, water absorption, water purification, and provision of habitat for fish and wildlife, marshes must not be drained or filled. The choice of controls to preserve marshes in their natural state will depend on the extent to which these functions are to be preserved and on the market value of the marshes for other uses.

If public action to preserve marshes will not markedly reduce their market value, uncompensated regulation can be used. If compensation is called for, it can be in the form of compensatory regulations, leases, covenants, or easements. Each has its special role. Fee acquisition would be called for only when heavy public recreation use is desired or when restriction of uses would severely reduce market value.

In the Philadelphia area, most of the marshes are adjacent to the Delaware River. Many have high potential market value for port uses. Where marsh functions are to be preserved, fee acquisition often will be necessary. Here, planning for marsh use should be carried out principally by the Delaware River Basin Commission. Plan implementation is principally a function of the states and local governments.

Aquifer and Aquifer Recharge Controls

The quality and quantity of the water needed for withdrawal from an aquifer will affect the uses which can be permitted in the area which recharges the aquifer. The aquifer itself need be controlled only as to permitted withdrawal, or penetration by canals, injection wells, etc.

To protect water quality in the aquifer, both salinization and pollution must be controlled, the former by maintaining sufficient fresh water flow through the aquifer from the recharge areas and the latter by limiting unsewered land use in recharge areas. Farms, forests, and recreation areas, as well as fully sewered urban development, will be appropriate uses in many recharge areas and over most aquifers. In some, however, where there is a direct connection from surface to aquifer, even sewered development should be restricted because of the inevitable tendency of sewers to leak.

On the other hand, some unsewered uses may be acceptable, depending on the character of the strata and the distance between the recharge area and the aquifer. Controls to protect water quality in the aquifer can take the form of regulation of land use in the recharge areas, with the regulation enacted under the public power to protect health. Whether the regulations should embody performance standards or, instead, fix a range of permissible uses related to various land conditions will depend on detailed knowledge of the relationship between the recharge areas and the aquifers to be protected.

The justification for controlling use of recharge areas to augment the *quantity* of the flow to and from aquifers rests principally on the power to promote the general welfare. Regulation relying on this power probably will fail as an uncompensated taking far sooner than regulation enacted under the public health power. In other words, it is suggested that a greater loss in vlaue of private land can be imposed by regulation when the regulation is enacted for the public health than when it is enacted for the public welfare. To achieve minimum runoff and maximum percolation of water to aquifers, the use of the recharge areas may have to be restricted severely. Limitation of use to open space activities or to sewered development with a 15 percent site coverage has been recommended in this study as a means of maintaining the quantity of flow. Where land values are low, the necessary use restrictions can be enacted through regulation. Elsewhere in urban areas landowners must be compensated; this can be accomplished by imposing the use restrictions either through compensatory regulations or easements. . . .

Flood Plain Controls

Preservation of flood plains in their natural state, providing flood waters a place to spread out, lose their momentum, and be stored, is one way of reducing flood damage and of retaining some of the flood flow to recharge aquifers. Uses compatible with fulfillment of the flood plain's water resource functions are those which do not impede flooding, which do not constrict stream flow at flood peaks, and which in turn are not injured seriously by flooding.

Virtually all uses which leave the flood plain land open would be appropriate, including development lots so long as structures and on-site sewage disposal systems were located outside of the flood plain. Of course, for any given flood frequency the contribution of the flood plain to reduced flood damages, the probable costs of flood damages, and the value to the community of permitting various forms of development in the flood plain must be weighed. In many areas, if land use is limited to those uses compatible with preservation of the flood plain's water regimen functions, the restrictions may have a severe impact on market value of urban land.

Because the combination of uses permitted, flood dangers posed, and existing market value will vary from flood plain to flood plain, the land use controls will also vary from regulation to fee acquisition. Regulation might be used where flood plain development would pose a threat to the health or safety of flood plain occupants or to the community at large; it might also be used where land values are low. Compensatory regulations, easements, restrictive covenants, and leases can be used where compensation of landowners is necessary but no public use of the land is contemplated. Fee acquisition may be necessary where land values are very high or where extensive public use of the flood plain is planned. . . .

Forests and Woodlands

Tree cover is maintained to slow water runoff. Trees also have an important effect on microclimate. Some development can be permitted within forested areas without seriously impairing their ability to slow runoff, so long as the site coverage of the development and tree cutting are restricted. Ten percent site coverage has been suggested as a maximum including structures, roads, and parking areas. Limitation on coverage should be accompanied by restrictions on clearance and cutting of tree cover. For all practical purposes this translates into a density of about one unit to the acre.

Land use controls to preserve tree cover should be enacted as part of the implementation of a river basin plan for regulation of runoff and recharge of aquifers. Regulation may prove adequate for forested uplands far from development pressure. Forested flood plains and marshes often are located in high value areas; where this is so, their preservation will require compensation, through use of compensatory regulations, covenants, easements, leases, and, sometimes, fee acquisition. Where development is permitted in conjunction with tree preservation, the controls would govern site coverage, tree cutting, and alteration of natural contours by grading and filling. If public recreation use of forested land is intended, easements or rights-of-way may be acquired or, of course, the land may be purchased in fee.

In the Philadelphia SMSA, the Commonwealth of Pennsylvania could control use of forested uplands, all of which are located in Pennsylvania, while public agencies at all levels could share responsibility for the forested flood plains and marshes located in both states, and the counties and municipalities could regulate site improvements accompanying development through subdivision regulations.

Steep Slopes

Steep slopes are subject to erosion unless water runoff is checked. Tree cover, or agriculture which incorporates terracing, strip cropping, contour cultivation, and controlled grazing are ways of maintaining such slopes. Rapid runoff from steep slopes also contributes to flood hazards.

Slopes in excess of 25 percent may best be kept undeveloped, and forested with adequate tree cover to check erosion and runoff. Uses should be limited to recreation and controlled timber cutting. Slopes between 15 and 25 percent are of course very developable, but site coverage should be limited to ten percent. This restricts it to either low density development, or high density with low coverage. Such slopes are also usable for agriculture, subject to land management restrictions.

If use restrictions for steep slopes are enacted, not only for water resource management but also to protect would-be occupants from health and safety hazards, then zoning or other regulatory measures can be used. Where the controls are employed to protect the community at large from flood hazards and soil runoff, the type of control may range from regulation to fee acquisition, depending on changes in the market value of the land prior and subsequent to imposition of the land use restrictions. On the slopes in excess of 25 percent it may be necessary to plant trees in order to assure an adequate tree cover. Owners may voluntarily agree to a public forestation program for their land, but, if they do not, the public must acquire either the fee, and follow up by planting and resale or lease, or an easement for access and planting.

Choice of levels of government control use of steep slopes will depend on the size and regional importance of the areas to be controlled. Hopefully, a river basin plan would determine the importance of maintaining natural cover on steep slopes and would fix standards and specifications for their use. Every level of government from the municipal to the state or regional agency might have a role in implementing this plan.

Prime Agricultural Land Controls

Prime agricultural lands adjacent to urban areas are becoming a relatively scarce resource. Their value for agriculture has declined in the face of agricultural surpluses, and their value as urban building sites has increased, in many instances dramatically. They are perhaps the most vulnerable of the eight classes of land types, but in the present concept of natural process, are less directly significant to the water regimen than the other seven.

Where prime agricultural land does not coincide with and depend for protection on any of the other phenomena, its retention must largely depend on a general consensus as to its amenity value or upon value for agriculture. Where such a case can be made, compensation to owners is very likely required. Conservation districts might be formed to take action for the special purpose of acquiring the fee and selling or leasing back the farmland for farm purposes. State and local governments might act in this way, if appropriate enabling legislation were passed.

For purposes of setting limits on development, examination of existing urban fringes suggests 25 acres as the minimum tract size which will ensure the open quality of the farmland.

Reducing Air Pollution Through Land Use and Public Facility Planning

Land use and public facility planning can be used to reduce air pollution. The methods range from large to small scale, from long-range to short-range, and from theoretical to applied.

Strategies are broad policies that define a course of action. Techniques are the legal, organizational, functional, and financial tools and processes through which strategies are implemented. Table 2.1 is an overview of the strategies and techniques that are discussed.

Large scale, long-range, theoretical methods are discussed first, under the heading "Regional Development Strategies." These are goal-oriented, and treat air pollution as one criterion for reshaping the land use pattern of an entire region. Small scale, short-range, applied methods are discussed last, under the heading "Location and Design Strategies." These are geared to solving immediate problems without departing substantially from current land development trends. The evaluation of primary and secondary techniques is based on the authors' experience and judgement.

Regional Development Strategies

On the regional and metropolitan scale, urban planners have responsibility for preparing long range plans (20 to 50 years) for producing a more rational and more humanly satisfying environment. The achievement of this objective requires the sensitive consideration of alternative arrangements of the region's physical structure, including: the shape, density and organization of settlement areas; the orientation and composition of subareas; the pattern and type of transportation system; and, the shape and location of major open space. . . .

Alternative Regional Forms

There exist numerous strategies for urban form and growth which entail specific land use arrangements. These strategies may have particular importance for air pollution control. In selecting from a variety of urban growth concepts, therefore, the planner should be conscious of their relative significance for air pollution control, particularly with regard to potentials for improving air pollution dispersion efficiency and reducing automobile travel (and thus auto emissions).

The following discussion of studies conducted in Hartford, Chicago, Seattle, and Prince George's-Montgomery Counties, Maryland, demonstrates the relationship between land development patterns and air pollution.

From A Guide for Reducing Air Pollution Through Urban Planning, prepared for the Office of Air Programs, The Environmental Protection Agency, by Allan M. Voorhees and Associates, Inc., and Ryckman, Edgerley, Tomlinson and Associates, December 1971, pp. 2-1 to 2-36.

LEGEND

■ PRIMARY TECHNIQUES

● SECONDARY TECHNIQUES

STRATEGIES	A. REGIONAL DEVELOPMENT				B. LOCATION & DESIGN						
TECHNIQUES	1. Alternative Regional Forms	2. Balanced Communities and Subregions	3. Low Density Development	4. Regional Open Space Patterns	1. Location of Stationary Sources	2. Relocation of Stationary Sources	3. Control of Land Use Around Sources	4. Location of Sensitive Receptors	5. Location & Design Control of New Towns	6. Planned Unit Developments	7. Small Open Spaces
Comprehensive & Project Planning	●	●	●	●	■	●	●	■	●	●	●
Localized Zoning (Location & Density)	●	●	■	●	●	●	■	■	●	■	●
Regional Zoning (Location & Density)	■	■	■	■	■	●	■	■	■		
Performance Zoning					●						
Non-Conforming Use Laws						●	●	●			
Zoning Regulations for Site Use										●	■
Air Zoning & Smokeless Zones			●		●						
Subdivision Regulations								●	■	■	
Land Dedication Regulations										■	
Planned Unit Development Regulations								●	■	■	
Building & Housing Codes			●							●	
Urban Renewal		●				●	●	●	●	●	●
Land Acquisition Programs	■		●	■				●		■	
Open Space Tax Incentives	■		●	●							
Location & Relocation Incentives	●	■	●		●				●		
Speculative Public Investment	●	■			●	■			●		
Tax Equalization or Gov't Consolidation	●				■	■			●		
A-95 Review	●	●		●	●				■		●
Direct Urban Design		●								●	●

Table 2.1 Urban Planning Strategies and Techniques for Reducing Air Pollution

Hartford Studies--A comprehensive analysis of the relationship between air pollution and land use was undertaken for Hartford, Connecticut, by Yocum and others.[1] This study showed clearly that the distribution of air pollution concentrations was related to the arrangement of land development. Emission inventory maps were developed, based on the predicted geographical distribution of land development and population, as well as on assumptions about control technology. The land use development pattern for the year 2000, approved by the Capital Region Planning Agency, was used as a basis for estimating future air quality.

An alternate plan for the Capital Region would terminate all further development in the Connecticut Valley and concentrate all future development along two highways to the northwest and the southeast. This arrangement would produce a developed area elongated in a direction perpendicular to the prevailing winds in the region. This scheme would produce by the year 2000 an air quality pattern with the total area of unacceptable air quality somewhat less than the approved plan but with the area of questionable air quality somewhat larger.

Another study for the Hartford region has looked into the interrelationships between land use and trip length.[2] The study considered five alternative land use plans. . . for the year 2000. These land use plans represent the development pattern required by present zoning regulations and four alternative arrangements of land use that might be selected as desirable goals for the region's growth.

In each case, the population and number of jobs are the same but the distribution and intensity vary. . . .

The difference between the trip lengths, and hence in automotive air pollution, produced by the Balanced Community and the Single Center Concepts could be as high as 22 percent. Land use plans can have significant effect on trip lengths, and consequently on automobile-produced air pollution.

Chicago Study--In Chicago, the air pollution implications of three alternative metropolitan plans were analyzed on the basis of emission estimates for two pollutants: oxides of nitrogen emissions and suspended particulate emissions from certain industry groups.[3] The alternative plans investigated consisted of a Finger Plan (high-density corridors), a Multi-Town Plan, and a Satellite Cities Plan. For these two pollutants, it was found that the Finger Plan and Satellite Cities Plan were equivalent with respect to particulates, and both were about 30 percent lower than the Multi-Town Plan;the Finger Plan, however, produced fewer oxides of nitrogen than the other two plans.

On the basis of these tests, it was concluded that the Finger Plan was the best alternative for air quality. Although this plan had fairly high residential and industrial concentrations, it also provided dilution potential for pollutants. This was true because the development corridors were elongated and bordered on either side by large green areas. Thus, the presence of green areas adjacent to pollutant sources is an important land use factor in pollution reduction. In both cases, the land use option providing the greatest opportunity for pollutant dispersion over green areas resulted in lower apparent pollutant concentration.

Seattle Study--In Seattle, Washington, two alternative transportation networks, based on two different land use systems, were evaluated for their effect on air pollution.[4] The two plans were: Plan A, continuation of the existing trends in land development; and Plan B, development patterned into a "Cities and Corridors" concept. Total emissions associated with Plan A were about 12 percent higher than those associated with Plan B. The analysis concluded, however, that the land use configuration preferable for air pollution reduction cannot be determined until total area emissions and, more importantly, total ambient pollutant concentrations are estimated and compared.

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[1] J. E. Yocum, D. A. Chisholm, and G. F. Collins. Air Pollution Study of the Capital Region. Capital Region Planning Agency, Hartford, Connecticut, December 1967.

[2] A. M. Voorhees, C. F. Barnes, Jr., and F. E. Coleman. Traffic Patterns and Land Use Alternatives. Highway Research Board Meeting, Washington, D.C., January 1962.

[3] Northeastern Illinois Planning Commission. Managing the Air Resource in Northeastern Illinois, Technical Report No. 6. August 1967.

[4] J. A. Kurtzweg and D. W. Weig. Determining Air Pollution Emission from Transportation Systems. National Air Pollution Control Administration.

Maryland (Montgomery-Prince George's Counties) Study--The effect of alternative land use plans, transportation networks, and operational characteristics in reducing air pollution were also evaluated for Montgomery and Prince George's Counties in Maryland.[5] In order to quantify the effect of alternative land use plans and highway networks on air pollution, a measure of the amount of air pollutants generated by automobile travel associated with each land use plan was required. Relationships were developed between vehicle miles of travel, emissions of pollutants, and speed. On the basis of curves relating emissions to auto speeds, air pollution produced by the alternative plans was calculated based on congested and average operating speeds. . . . In comparing the alternatives an index of the weighted average of pollutants produced per vehicle mile was calculated. This index was used to choose the plan that contributed the least air pollution as a result of less overall congestion in the network and the arrangement of the transportation system and urban development.

Conclusions--As indicated by research that has been done to date, improved regional development patterns should reduce auto emissions and the number of persons exposed to pollutants from both vehicles and stationary sources. However, as was concluded in the Seattle study, the determination of preferable land use patterns cannot be made until total area emissions and, more importantly, total ambient pollutant concentrations are estimated and compared. Two basic conclusions can be drawn regarding the effect of regional development concepts:

> a. Models for simulating the air pollution impacts of alternative development forms need to be made more comprehensive in their capacity to accommodate corridor variables (i.e., trip length, travel speed, population density, ambient air conditions, stationary source emissions, etc.). None of the studies reviewed for this project, for instance, evaluated development plans from the standpoint of both auto and stationary emissions.
>
> b. Even when such multi-variable models are developed, it will be difficult to make generalizations about optimal development forms. Localized investigations will be required due to significant variations in regional ambient air quality levels, the location of major stationary sources, the climatological conditions, and the travel behavior of residents.

With regard to trip lengths, it remains for the planner to consider the effect of various land use concepts upon trip length in a given metropolitan area. Minimum travel distance should be incorporated into the land use plan selection criteria. It must be understood, however, that shortening trip lengths is not a universal panacea for improving air quality. . . . It is important to give equal attention to increasing traffic speed and population density reductions, both of which can be incongruous with the minimum travel distance criterion.

Balanced Communities and Subregions

By taking a small area approach to regional and metropolitan development it is possible to increase opportunity, accessibility, and convenience. The net result of creating subregions, each having a balanced supply of employment facilities, retail and service centers, and housing types and prices, can be a significant reduction in peak-hour auto travel. One study[6] concluded that travel could be minimized through creation of defined subareas. The key factors in this type of development are:

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[5] A. M. Vorhees, and Associates, Inc. A Transportation Study for Montgomery and Prince George's Counties, Maryland. The Maryland National Capital Park and Planning Commission, June 1970.

[6] Supra 2.

a. Populations should range in the order of 100,000 to 200,000. . . .
b. Subregions should be as distinct and isolated from one another as the natural topography and existing development pattern will permit.
c. Street and highway systems should be laid out to focus on the subregional center(s).
d. High density residential development should be located within 10 minutes travel time of high density commercial and employment areas.
e. Housing must provide a wide range of types that will attract a diversity of social and economic groups.

The reduction of trip lengths and the increased potential for non-auto trips (transit and walking) caused by implementing this balanced subregional concept. . . results in a reduction of auto pollution emissions comparable to the reduction of auto travel.[7] Furthermore, this type of development pattern is also highly compatible with other planning objectives (i.e., wider housing opportunities, reduced sprawl, more economical public service delivery, revitalization of central business district, etc.).

The subregionalization concept could be applied in a number of ways:

a. Guiding the establishment and design of new towns which are currently being considered, planned, or developed in a number of metropolitan areas.
b. Providing a framework for new suburban development.
c. Restructuring and renewal of built-up sections of metropolitan regions, including "new towns-intown."

Low Density Development

The potential impact which population density variations have upon automobile pollution concentrations has been demonstrated by Rydell and Collins in a simulation study.[8] Application of the Rydell-Collins density equation over the range of population densities (gross residential density) occurring in the simulated city revealed that automobile pollutant concentrations decreased as density decreased. Thus, it could be concluded from this study that land use policies which are designed to achieve lower overall population densities will, all other things being equal, improve ambient air quality.

Obviously, this raises a number of difficult questions about the effect of residential density. As pointed out previously, lower densities stimulate trips of consistently greater length, thereby causing an increase in overall travel of 10 to 20 percent. The Rydell-Collins study would seem to conclude that the dispersion of people and automobiles over a larger area creates a condition of lower pollutant concentration which compensates for the added pollution due to increased vehicular miles of travel.

In fact, however, this pioneering study has only proven the need for additional research. Such research would have to be more sensitive to: (a) trip length factors as well as trip generation rates; (b) lost potential for transit travel caused by the lower densities; (c) the fact that in most cases the trip generation rates for low density development are higher than for medium and higher density development.

For the time being, density changes on a broad scale appear to be somewhat neutral in effect. On a smaller scale, however, density reduction can have a significant effect. For example, reducing density of development around major stationary sources of aerial wastes, such as industries or power plants, will, depending upon climatological and topographic conditions, tend to reduce the number of people affected by emissions from such sources.

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[7] For example see: Alan M. Moorhees & Associates, Inc. Factors and Trends in Trip Lengths. National Cooperative Highway Research Program, Report 89, 1960.

[8] C. P. Rydell and D. Collins. Air Pollution and Optimal Urban Forms. National Center for Air Pollution Control, June 1967.

Regional Open Space Patterns

The use of open space or buffer zones to separate aerial waste sources from residences has long been a technique employed by planners. In addition, open spaces can be used to shape the community into the desired growth pattern; more recently, it has become known that open space can provide better dispersion of air pollutants. Some research ha been done on this subject and much more is underway and needed, but there are some known techniques which are relevant.

Effective dispersion of air pollutants does occur over open space and is increased if the land is planted. By absorbing moisture and then cooling by evaporation, greenery creates a cooler, more humid surface which keeps dust and other pollutants on the surface.[9]

The location and size of open spaces are important. Wind direction, type of pollutants, etc., are all relevant. Generally the width must be much wider than the narrow buffer strips common today.

A variety of open space systems, some of them empirically derived, has been proposed on the basis of potential diluting, absorbing, and settling effects of buffer space. Hilberseimer has suggested[10] that when winds blow from a single direction there should be rows of built-up areas separated by green zones, with the industries on the leeward side of the development. The green zones should be broad enough to reduce air pollution to acceptable levels before the winds reach each succeeding residential strip. When the wind direction varies over a range of less than 180 degrees, Hilberseimer has concluded that diamond-shaped arrays of industrial and residential locations are best; and over a range of more than 180 degrees, triangular arrays are best.

In certain geographical areas, however, the green bands strategy may be very difficult to implement. For example, because of the dispersed wind pattern and source locations in the Chicago area, it would serve little purpose to plan land use according to wind direction. Generally speaking, the area's wind patterns pose a threat to people in all directions from major sources. In such a case, buffer zones would have to completely surround these sources. The 5,000 acre greenbelt being preserved around Yellow Springs, Ohio, as well as circumferential park systems (the Emerald Necklace) around Cleveland, Ohio, are examples of this pattern of buffering.

Perhaps more effective is the creation of open wedges or corridors radiating from penetrating toward the center of the metropolitan area. In this system almost all development is only minutes away from open areas. Such proximity to open space helps in the diffusion of aerial wastes. This was well supported in the Chicago tests on alternative development forms in which the Finger Plan (i.e., a concept based upon corridors of development and wedges of open space) proved to generate the least air pollution impacts in spite of the proximity of several of the fingers to high concentrations of stationary pollution sources.

While the research is still inadequate, it does appear that the use of regional open space systems to help disperse pollutants can be of significant value. Furthermore, when its dispersion potential is added to all the other benefits of open space preservation, the case for implementation of land preservation programs becomes quite convincing.

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[9] C. P. Rydell and G. Schwarz. Air Pollution and Urban Form: A review of Current Literature. AIP Journal, March 1968.

[10] L. Hilberseimer. The New City. Chicago: Paul Theobole, 1944.

Implementation of Regional Development Strategies

To accomplish the restructuring of metropolitan areas according to the strategies described above would call for every tool planners have in their kit, plus some that have yet to be developed. Regional zoning would be a most effective tool but only a few areas such as the Jacksonville, Indianapolis, and Nashville consolidated governments are currently able to exercise such power. In absence of such centralized public land control in most areas, a high degree of voluntary coordination, review, and referral must suffice. Furthermore, implementation will call for a very carefully executed program of reclassifying vacant land to buildable zoning districts. If intensification of land use, redevelopment of built-up sections, and preservation of open space are to occur, land must be made a scarce resource so developers, builders, employers, and politicians will be deterred from current "spread city" development patterns. Some alternative tools which might convince development interests to follow new development strategies include:

a. Massive open space preservation programs which tend to define and channel development opportunities (techniques could include fee simple or easement acquisition, new tougher conservation zones, and tax deferrals).
b. Restrictive public sewer and water extension policies in concert with tight regulation of on-site sewer and water systems.
c. Tax incentives for developments which follow the "plan."
d. Entry of local and state governments in the business of development and redevelopment. (New York's Urban Development Corporation is one of the best examples of "public interest" developers.)
e. Control of new town locations and designs through metropolitan and state clearing houses in their exercise of A-95 review powers.
f. Decentralization of low and moderate income housing from congested cities to all sections of the metropolis so that employment facilities can be closer to the total range of needed occupational skills. (A-95 review power over all federally assisted housing, presently limited to single-family housing developments of more than 50 units and multi-family developments of more than 100 units, would be the tool for promoting such housing goals.)
g. Selection of urban renewal projects which would encourage concentration of jobs and people in close proximity. However, judging from the difficulty many renewal programs have had in attracting developers, additional incentives may be required.
h. Selective placement of public facilities and services so that they serve as positive "development shapers." In other words, through capital improvement programs, model cities programs, A-95 review of federally assisted facilities, and the planning and programming of improvements of highway and utility systems, development can be stimulated, shaped, intensified, or modified. This kind of public entrepreneurship departs from the standard "supply follows demand" philosophy, but it is being done more and more frequently by local governments. Furthermore, denial of public service and facility improvements can maintain clarity and definition of the subregional cluster boundaries.

Location and Design Strategies

While modifications of regional and metropolitan form can apparently provide pollution-reduction payoffs for relatively large numbers of metropolitan dwellers, the facts remain that those payoffs are long-range and that we currently lack some of the more important land use tools required to implement them. Through selective application of location and design strategies, however, it is possible to generate some shorter range effects which fall essentially within the current range of planning powers. The following discussion describes and evaluates some of these strategies.

Location of Stationary Sources

In formulating comprehensive plans, the planner should attempt to locate large industries and industrial areas so as to minimize their effects on residential and commercial air quality. Hazardous air quality conditions which exist today can often be traced to poorly located industry. For example, many industrial areas historically developed in river valleys in order to benefit from cheap transportation.[11] Depending on the surrounding topography, such valleys are often the worst locations for sources of harmful emissions.

The impact of pollution from industrial land uses can be reduced not only by source control technology, but also by careful location planning of such areas with respect to the local dispersion characteristics and with respect to residential development location and densities. Because it is always desirable to ensure that aerial wastes are discharged away from residential areas, the planner must make increasingly comprehensive studies of local meteorology, climatology, and topography in order to improve spatial arrangements of industrial, commercial, and residential areas. In fact, these considerations should become fundamental determinants of industrial location decision-making along with such criteria as amount of existing vacant land, land cost, accessibility, demand for existing industrial activity, and compatibility with adjacent land uses.

In general, the ideal site for industrial sources of aerial waste is comparatively level terrain in a region where the average wind velocity is ten miles per hour or more, and where deep temperature inversions rarely occur.[12] However, because dispersion characteristics vary among regions, the planner is urged to investigate the relevant conditions of specific areas and to assess land uses accordingly. Following are two examples, illustrating the significance of local dispersion characteristics in land use planning.

When rebuilding Volgograd (formerly Stalingrad) after World War II, its planners recognized that the wind almost always blows from the same direction. They designed the city in major land use strips perpendicular to the wind. The wind does not pass over the industrial area until it has passed all of the other uses.

Placing the industrial area on the leeward side of the city is not always the solution, however. In Linz, Austria,[13] located in a mountain valley, industrial sources were sited on the eastern side of the city to take advantage of the prevailing westerly winds. On occasions when the more mild easterly wind is in effect the pollution is banked against the mountains and the residential area is often blanketed by smoke.

The problem at Linz was caused by the effect of low velocity winds on air pollution concentrations. While high velocity winds disperse air borne pollutants, low velocity winds may prevent dispersion. Wind frequencies and speed must be considered in the planning process prior to locating industrial areas to keep emissions away from residents.

Zoning -- The implementation of such plans for new industrial locations is normally carried out through zoning regulations, which generally have between one and five categories of industrial land. . . . The consideration of air pollution and other obnoxious effects attributable to industry has taken place for a number of years. However, the regulatory process has been only partially effective because:

a. Community leaders are increasingly anxious to strengthen the tax base with industrial development and often will amend zoning regulations to allow industries to locate wherever they desire.

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[11] Urban Land Institute. Land Use Control, Research Monograph No. 17, 1970.

[12] St. Louis Area Council of Governments. Report and Recommendation of East-West Gateway Coordination Council as a Coordinated Air Pollution Abatement Program for the St. Louis Metropolitan Area.

[13] Supra 9.

b. Zoning power is decentralized to many local jurisdictions within a region, and inter-community air pollution effects are often not considered.
c. Almost every city (particularly large central cities) has its share of improperly located heavy industry which was built prior to the adoption of zoning. Non-conforming use provisions have not had the enforcement procedures necessary to relocate those industries which are in conflict with surrounding uses.

In spite of these drawbacks to use of the zoning power, it remains the best tool available and has been used with increasing effectiveness in locating suburban industrial areas. Zoning regulations, in order to promote further reduction of air pollution concentration, must be reexamined in light of the effect that metropolitan meterological and topographic characteristics have upon pollutant dispersal.

Performance Zoning--Consideration ought to be given to the performance zoning approach. Performance standards are a method, usually limited to industrial classifications, under which zoning districts are established not by a detailed catalog of specific permitted uses, but by scientific measurement of the external nuisance impact of the operation. Any use may be located in any industrial district if it can comply with measurable standards for noise, glare, odor, vibration, fire safety, smoke, and toxic matter. . . .

The use of performance standards has much in its favor, but it does have some drawbacks which have not yet been overcome:

a. Performance zoning requires extra enforcement personnel with high technical ability. (One suggested solution is to shift the measurement and enforcement costs to the industry.)
b. Some industries are reportedly unwilling to locate in areas where they cannot determine compliance with the standards until after their plants are built.
c. If, after the plant is built, it is concluded that the emission standards cannot be met, local governments are going to be quite reluctant to tell that industry to relocate.
d. The emission standards are usually limited to particulates and toxic matter when, in fact, carbon monoxide, sulfur oxides, oxides of nitrogen, and hydrocarbons may be equally harmful to the health of surrounding households.
e. Since meteorological conditions are not taken into account in setting standards, the actual air pollution impact may vary from plant to plant.

Another important factor is the relationship between performance standards, which are usually administered by planners, and emission codes, which are usually administered by health departments or air pollution authorities. Obviously, a conflict of standards is undesirable. Because source control is so important, it is suggested that planners encourage the proper local authorities to adopt comprehensive emission codes and enforcement programs. If this happens, then the zoning performance standards relating to stationary source emissions should be made compatible or deleted from the ordinance.

For example, under the 1967 Clean Air Act passed by the State of Washington, performance standards are superseded by the rules and standards promulgated by county, multi-county, or regional air pollution control authorities unless the zoning performance standards are more stringent. Furthermore, agreements should be drawn up to describe the mutually supportive roles to be performed by each agency. The most logical approach would be for the health department or air pollution authority to concentrate on obtaining compliance from existing industries while the planning agency concentrates on trying to avoid new problems.

If there is no county or regional air pollution authority or if emission regulations have not been developed, it is suggested that the planning agency amend the zoning regulations to include measurable air emission standards governing the performance of source operation. Such standards should cover all major types of pollutants (i.e., gaseous as well as particulate emission) and should be backed by a well staffed enforcement program. However, if the jurisdiction's inspection office is understaffed or is not able to obtain the expertise required to develop and enforce such standards, it is probably wiser not to venture into this area.... In such a case, the greatest contribution to be made by the planning agency is to build air pollution considerations into the location of industrial areas on the zoning district map and to encourage development of a county or regional air pollution monitoring and enforcement program.

Air Zoning--Another variation of the zoning power would be to establish restricted areas within which pollution producing industries would not be permitted. Such restricted areas would be based upon evaluation of current ambient air quality, topography, land use, population density, and the atmospheric dispersion characteristics. In Britain, "smokeless zones" have been legislated in order to eventually eliminate aerial wastes within designated areas. In practice this strategy has suffered from highly subjective judgments and difficulties in enforcement. Furthermore, like performance zoning standards, only particulate emissions are regulated. However, it would seem possible to modify the approach so as to broaden the range of pollutants and to provide more objective measures and enforcement programs.

The primary value of this approach is that such zones could be imposed at the regional level as an overlay district, without having to take all zoning powers away from the localities. This makes it much more practical to implement than regional or metropolitan zoning. It would, in most cases, require new state legislation to create both the authority and the organizational machinery to establish, evaluate, and enforce such air quality zones. In effect, this would result in the setting of subregional ambient air standards for critical sections of a region, except that, in this case, the standards would be attached to the authority to exercise the "police power" as it relates to land use.

Even if not carried through to legislative action, the designation of such air quality zones in regional and community comprehensive plans would be of service to public officials. The zones would provide a valuable input to the consideration of zoning amendments and the location of new public facilities.

Power Plants and Airports. Power generation plants and airports also have critical impact upon air quality. Locational decisions regarding these two land uses are required infrequently, but when they are it is important that the planner become fully involved in the consideration of alternative sites.

Power plants are usually the largest single source of sulfur oxides; airports, particularly the new regional jetports, are generators of particulates, carbon monoxide, oxides of nitrogen, and hydrocarbons (concentrations of the latter are being reduced through modification of jet engines).

The location of electrical power plants, which generally consume extraordinary amounts of coal, can be best controlled by making them a "special permit use" or "special exception" rather than by considering them a "use by right" within specific zoning districts. The "special use" approach allows more flexibility in defining the best location and also provides the planning agency with greater control over the location and site planning of such a major land use. Future power plants apparently will be shifting to nuclear fuel but there are still problems of public safety with regard to operation and disposal of nuclear wastes.

As with industry, locations should be determined on the basis of good atmospheric and topographic diffusion characteristics and should be downwind from urban development. Buffers are usually of little value due to the wide area affected by power plant emissions. Strict control of new locations, plus public regulation of existing source operations (i.e., fuel conversions, emergency production curtailment, and emission codes) should produce the greatest improvement.

Airports and jetports are expanding rapidly and new locations are being considered in several metropolitan areas. . . . The control which an urban planner has over public airport location lies more in his planning role than in his administration of zoning regulations. Since the airport is usually a public use, it is generally permitted in any district. Although certain zoning regulations consider airports as "special permit uses," there is often a provision which allows the legislative body to exercise such locational decisions without review by, and recommendation from, the planning or zoning board. Thus, the most important contribution of the planner is in the evaluation of the air pollution aspects of various alternative locations and/or expansions during the early stages of airport improvement studies.

Solid Waste Disposal. With regard to solid waste disposal, the first step is to outlaw open burning. Most states have already done this, but the implementation of these laws can be speeded up through the provision of alternative disposal systems (i.e., landfills and incinerators). Landfills, if well operated and managed, offer only small problems in aerial waste generation (dustfall and blowing debris). New incinerators, however, can be major sources and require the planner's attention in considering rezonings and in preparing solid waste disposal plans. The best solution is: (1) advance planning of future sites on the basis of minimizing environmental impact; and (2) promoting public acquisition of such sites in advance of urbanization so they will be available when needed. Air pollution emissions from incinerators can be reduced somewhat through the use of buffer zones. But again, it must be emphasized that any planning strategy or technique must be accompanied by controls at the source.

Relocation of Stationary Sources

Although the principles of industrial location have changed significantly since the early 1900s, there are still large numbers of manufacturing plants located too close to medium and high density residential areas and within low lying basins which do not easily diffuse aerial wastes. Many of these plants also produce blighting influences due to their traffic generation, noise, safety hazards, structural deterioration, and water pollution. Most were constructed prior to the local government's adoption of zoning regulations.

Within most metropolitan areas, these industrial plants expose between 20 and 50 percent of the current population to emissions of particulates, carbon monoxide, sulfur oxides, and hydrocarbons. To complicate matters further, most of the affected persons are in low and moderate income categories and can least afford the cost of relocation, of medical bills for treating respiratory ailments, or the loss of a few days' work.

Ideally, the solution would be to relocate these industrial operations to areas where their pollutants would be more adequately dispersed and where there would be few nearby receptors. When this option is approached practically, however, many legal, financial, social, and physical issues arise. How will the neighborhood residents travel to the plant's new location? Can the city afford the tax revenue losses if the plant is relocated in another jurisdiction? Will the industry close down if this additional economic burden is placed on its shoulders? Can the plant, through enforcement of emission standards, be made to reduce emissions to standard levels thus avoiding the need for a move? Does government have a clear legal right to force relocation? All these questions must be answered for each community's unique situation before relocation programs can be formulated and implemented.

Assuming for the moment that the answers to all these questions are positive, how does one go about the task of implementing a relocation program for major stationary air pollution sources? Some combination of the following techniques would be required for relocating major stationary sources:

a. *Non-conforming use provisions* have been contained in zoning ordinances for years for the purpose of restricting the expansion and the extended existence of land or structural uses which are deemed incompatibly located. Occasionally such provisions have incorporated amortization schedules in order to set time limits for the cessation of non-conforming uses. This is a "venturesome area with few guide-posts."[14] Some state courts have expressed opposition to amortization techniques; where they have been tried, "unpopular" uses such as bill-boards, gas stations, and auto wrecking yards have received most of the attention. Non-conforming use provisions, singularly, do not appear to offer great potential for relocation of sources.

b. *Urban renewal* projects and planning which precedes them (Community Renewal Programs and Neighborhood Development Programs) could be used to remove incompatible sources within blighted areas. Although most urban renewal programs have chosen to concentrate on clearance of housing and marginal commercial structures, some communities have used either spot clearance or comprehensive redevelopment programs to eliminate small polluting industries which are barriers to the redevelopment potential of the site.

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[14] Richard F. Babcock, Report on Contemporary Land Use Control Methods and Techniques. Dayton Plan Board, 1966.

c. *Financial relocation incentives* appear to be a necessary ingredient in any program for the removal of waste producing industries, either in combination with the zoning and renewal techniques or by themselves. Many inner-city industries do not have the capital to absorb relocation costs and, if incentives are not provided, they may be forced to go out of business. Incentives could take the form of direct relocation allowances or tax credits.

d. *Tax equalization or governmental consolidation* would be the most important incentive to industrial relocation. Most communities are quite reluctant to force an industry to move for fear that the industry will relocate outside the political jurisdiction, thus causing a loss in property and income tax revenue. It is doubtful then that any substantial relocation could occur until local taxation systems are made less competitive and more responsive to region-wide considerations.

In summary, although it would appear that a substantial portion of our population would be affected by relocating major industrial air pollution sources, the issue is far too interwoven with social, political, and economic factors to show any near-term promise of contributing to air quality improvement.

Control of Land Use Around Sources

If it is not possible to locate or relocate stationary sources so that their emissions are diverted from population concentrations (and this is often the case either because of dispersed wind patterns or traditional development patterns), certain actions can be taken to improve the situation through better control of development around the sources.

The following actions could be taken by the urban planner on the basis of his knowledge of ambient air conditions and dispersal characteristics of the areas around such sources:

a. *"Exclusive use" districting* to prohibit housing and commercial development within industrial zones.

b. Planning and zoning for *low density development and limited building heights* within the affected areas.

c. Providing *buffers* around sources in the form of open land (the best filtering effects come from a combination of rows of trees, shrubbery, and lawn).

d. Within industrial areas, providing for a *gradation of pollution* and employment outward from the middle. Industries with the worst pollution could be located in the center; "cleaner" industries could be located on the outside.

e. Within developed areas where conflicts exist:
   1. Preventing increases in population through zoning amendments; and
   2. Conducting *redevelopment and spot clearance programs* in order to remove dwelling units which are blighted by, among other things, the presence of air pollution.

Concerning the value of buffers, around sources, it is important to recognize the variability of their impact. Their value increases in direct proportion to the amount of source control of pollution that is effected. For instance, a study was conducted in Chicago which estimated diffusion effects on two gray iron foundries. Diffusion effects from foliage and structures were ignored. Uncontrolled and 75 percent controls were calculated for both plants; 95 percent controls were also calculated for the larger unit. (The smaller unit was rated at 10 tons per hour, while the larger foundry was rated at 25 tons.)

> At low or high wind speeds a buffer zone around an uncontrolled foundry would have to be unrealistically large to satisfactorily reduce downwind ground concentrations of particulate matter. With 75 percent controls for the smaller

> (unit) a buffer 2,130 feet deep would bring concentrations outside the zone below 100 micrograms per cubic meter. With an 82 foot stack, the plant would have to be centered on a site totalling some 400 acres. With 95 percent control of the large unit, concentrations at any point downwind would not go above the 100 microgram mark.[15]

Through control of peripheral development around sources in a manner which more sensitively incorporates air pollution considerations, a large part of the effect of aerial wastes can be reduced for a large number of people. Furthermore, the techniques described here, for the most part, are within the range of feasibility.

Location of Sensitive Receptors

In planning the land use patterns near emission sources, it is important to pay special attention to areas to be used by sensitive receptors: the young, elderly, and sick. Although no specific distance standards are available, the following land uses should be kept remote from emission sources:

a. Elementary and secondary schools.
b. Intensely used recreational facilities, especially outdoor play areas.
c. Orphanages and children's home.
d. Elderly housing facilities, senior citizen centers, and nursing homes.
e. Hospitals, clinics, medical centers, and rehabilitation centers.

The techniques for properly locating these land uses include zoning regulation, the A-95 review of federally assisted projects (health facilities and housing projects fall under this review), and close coordination with school administrators and recreation officials regarding advance planning of their site acquisitions. Where facilities within areas of poor air quality are impossible to avoid, either because they are there now or because such facilities have to be in close proximity to the neighborhood residents, improvements can perhaps be made to the site, the buildings, or the facility's operation (i.e., installing central air-conditioning, scheduling outdoor activities at non-peak hours, providing landscaped buffers, etc.).

Location and Design Control of New Towns

The Urban Growth and New Community Development Act of 1970 is now encouraging a great deal of new town development activity. At last count, "public and private developers from 23 states and territories have demonstrated substantial interest in building new communities. . . ."[16] Several new town projects are already under construction and indications are that the trend is just beginning to pick up momentum. The National Committee on Urban Growth recommends the creation of 100 new communities with 100,000 persons each and ten new cities of at least one million persons each. This would account for about 20 percent of this country's urban growth between now and the year 2000, but the financing required to make this happen is still a major obstacle.[17] However, even looking at the town potential with a more conservative eye, it would seem possible that between 5 and 10 percent of metropolitan growth could be attracted to new towns built either as satellite communities or as new towns in-town.

New town location and design will be important factors in improving the quality of urban life; more specifically, they will offer the urban planner the opportunity to deal more effectively with the air pollution problem.

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[15] Supra 3.

[16] American City Corporation. Urban Life in New and Renewing Communities, No. 6, July 1971.

[17] D. Rockefeller, New Communities, A New Avenue for Social-Purpose Investing. Address before New York Bond Club, April 1971.

First, the location of new towns offers an opportunity to place an entire community more carefully with regard to optimal diffusion characteristics. As was pointed out in the discussion of open space strategies, the separation of communities or subregions by large amounts of green space (as would be the case in many new towns) is an effective strategy. Furthermore, a new town can be situated with better regard for wind direction and speeds.

Second, through careful consideration of the new town's internal design it is possible to reduce the effect of locally generated airborne wastes. This can be accomplished through better location of stationary sources, the use of internal open space, the design of traffic/land use relationships, and the reduction of trip lengths and auto reliance.

Even if new towns are not successful in diverting large numbers of households away from the more conventionally developed suburbs and central cities, they have a large contribution to make in the area of experimentation and demonstration. New techniques of reducing air pollution and its impacts can more easily be tested in new developments and, if successful, then applied to the cities. For example, in France, a new city, Vaudreuil, is being planned for the lower Seine region outside Paris. The city will provide housing and employment for up to 150,000 residents. The design will utilize new technology to eliminate as much noise and air pollution as possible. Among the concepts under consideration are routing of traffic through underground passages and tunnels, carrying smoke from factories in underground conduits, burning gases off at the source, and processing refuse to supply part of the city's central hearing. The U.S. Department of Housing and Urban Development, together with other U.S. agencies, will make technical contributions to the French effort. The results of such innovative demonstrations will have great significance for our existing cities.

Urban planners can exert influence on the location and design of new towns through land use controls (zoning, subdivision regulations, special new community zoning districts, etc.), the encouragement or discouragement of such developments through the location and type of governmental capital facility investments, and the review of new community applications for Federal financial assistance (guarantees, loans, and grants). Professionals and lay boards at all levels of planning (state, regional, county, and local) can play a role in encouraging and guiding new town developments.

Planned Unit Developments

For many of the same reasons related above, except on a smaller scale, urban planners should encourage more innovative approaches to land development. In most cases planners are already providing such encouragement and are revising land regulations to allow more flexibility for development concepts such as planned unit development, cluster subdivisions, and density zoning. Such development forms will increase convenience and thus reduce trip length. Equally important, however, is the fact that such concepts permit the preservation of buffers and open spaces between emission sources (principally roads) and residences.

Most planned unit developments created thus far tend to be predominantly residential. However, the same concepts of design flexibility and mixing of land use types apply to the development of multi-use centers. A multi-use center (MUC) may be described as a concentration of living, working, and shopping land uses that are physically integrated by internal pedestrian systems.[18] The air pollution abatement contribution which an MUC can make lies in the significant reduction in trip lengths and the reduced need for automotive travel between the contained activities.

The Twin Cities Area Metropolitan Development Guide calls for 20 "diversified centers," essentially the same as MUC's, as part of the 1985 Constellation Cities Plan. . . . The unified architectural complex would house commercial facilities, offices, high-rise apartments, public facilities such as a hospital, and perhaps a college with easy pedestrian access. A metropolitan transit line would feed directly into the center, which would also be connected to the nearby freeway by its own interchange. An industrial park would be located nearby to share in many of the public facilities and services, such as mass transit, required by the diversified center. Parking closest to the center's facilities is accommodated in structures; more distant parking is accommodated on surface lots.

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[18] P. W. Kwantes, General Transportation Aspects of Multi-Use Centers. Unpublished paper, 1971.

. . . The development of suburban regional shopping centers, however, appears to be the greatest opportunity for creation of multi-use centers. Many shopping centers stimulate an intense development pattern around them but, because the surrounding land has not been planned and controlled comprehensively, they generally fail to generate the advantages of an integrated MUC. Such centers should be complementary to existing central business districts in large urban areas where there is a need to accommodate growth. The techniques through which new, more convenient land use forms can be created include:

a. Broadened planned unit development regulations which make all large commercial, industrial, and residential developments subject to site plan review and conditional approval agreements.
b. Urban renewal planning and project implementation.
c. Detailed planning studies, designed to pinpoint the best locations for multi-use centers, that define alternative ways of stimulating their development

Small Open Spaces

The impact of open space upon air pollutants is ill defined and somewhat non-quantifiable at this time. General consensus is that open spaces and buffers must be quite large in order to perform an adequate diffusion function. However, . . . small buffer corridors along roadways could have a dissipating effect on automotive carbon monoxide emissions. If developments were kept away from the roadway edge a reduction could be obtained in carbon monoxide concentrations. The placement of plant materials within that buffer could further increase the dispersal of pollutants and the protection of nearby residences. Although research has not been done in this area, the fact that trees and other forms of vegetation create some air turbulence and produce more humidity which can trap particulates appears to justify the creation of small open spaces.

The urban planner can contribute to the creation and preservation of these small open spaces by:

a. Developing regulations for requiring developers to provide land for parks or cash in lieu of the land.
b. Encouraging and guiding planned unit development.
c. Providing subdivision site plan reviews.
d. Expanding the right-of-way standards for thoroughfares.
e. Requiring larger setbacks.
f. Instituting beautification and roadside landscaping programs.
g. Developing tree preservation regulations.

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[19] The Joint Program (now the Twin Cities Metropolitan Council), Twin Cities Area Metropolitan Development Guide, Report No. 5, April 1968.

Outdoor Noise, Transportation, and City Planning

Melville C. Branch, Jr.

The prospect of sonic booms from supersonic aircraft affecting corridors on the ground 60 or more miles wide has alerted the public to the problem of outdoor noise in the environment. Although for years safety standards have limited noise from industrial operations inside buildings, outside noise has been largely ignored until recently.[1] Now, finally, city planning is awakening to noise pollution brought about by more numerous and powerful cars, busses, trucks, motorcycles, special vehicles, construction and other powered equipment, and more and more aircraft overhead.[2] As yet, however, none of these outdoor noise pollutions has been faced squarely nor the abatement of any assured in the United States. Dr. Vern Knudsen states the problem of noise pollution succinctly.

> In 1954 on the occasion of the twenty-fifth anniversary of the founding of the Acoustical Society of America, I reminded acousticians and the public that during the preceding 25 years the loudest noises to which man was exposed has increased 25 decibels, from . . . about 110 to 135 dB(A), an average of one decibel per year. I further reminded them that if this rate of increase continued for another 25 years, noise would reach a maximum level of . . . about 160 dB(A), which probably would be lethal for man. . . .
>
> The loudest noises to which urban man is presently exposed are generated by aircraft. Although motor vehicles are still the most ubiquitous contributor to urban noise pollution, aircraft noise is increasing at an alarming rate. An article in the February 1970 issue of *Scientific American* reports that from 1936 to 1963 the takeoff noise from civilian aircraft increased from about 100-130 dB(C) [85-115 dB(A)], thus continuing its inexorable rise of at least one decibel per year.[3]

If urban environmental noise is to be controlled and worse conditions prevented in the near future, it is certain that decisive steps must be taken *now*, based on available knowledge. To wait longer is to be too late. For by the time environmental pollution problems reach the point of widespread public response, there

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This article originally appeared in *Traffic Quarterly: An Independent Journal for Better Traffic*, Volume XXV, Number 2, April 1971, pp. 167-188. Reprinted by permission.

[1] E.g., *California-Noise Control Safety Orders*, Division of Industrial Safety (California Administrative Code, title 8, sec. 3870-72, with Appendix A), 1963.

[2] Alexander Cohen, Joseph Anticaglia, and Herbert Jones, "'Sociocusis'--Hearing Loss from Non-Occupational Noise Exposure," *Sound and Vibration* 4, no. 11 (November 1970): 12-20; Committee on Environmental Quality of the Federal Council for Science and Technology, *Noise-Sound Without Value* (Washington, D. C.: Government Printing Office, September 1968), 56 pp.

[3] Vern O. Knudsen, in *Outdoor Noise and the Metropolitan Environment*, eds. Melville C. Branch et al., Case Study of Los Angeles with Special Reference to Aircraft (Los Angeles: Department of City Planning, 1970), p. III: Vern Knudsen is Professor of Physics and Chancellor, Emeritus, University of California at Los Angeles.

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are so many investments and commitments represented by early inaction that standards rigorous enough to control the pollution are difficult to impose. As a rule of thumb, the time for effective action is 3 to 5 years *before* an urban problem is widely acknowledged.

Noise and People

Although intense sound can cause physical damage to buildings, plants, and animals other than man, it is because noise is hurtful to humans that we concern ourselves with its effects. The physiological effects have been investigated; prolonged or repetitive exposure to noise of certain intensities damages the mechanism of human hearing.[4] Investigations of such physiological injury are the bases for industrial noise limits in the public health and safety laws of many countries in the world. Recently, scientific study has extended our knowledge of the physical effects of noise to include chemical and physiological reactions involving blood, heart, eyes, skin, stomach, and esophagus. It is now well established that noise above 75 dB(A) produces temporary changes in the physiological state of man. ...[5]

Psychological effects of noise are less well established.[6] Tests have been made which indicate the "complaint" response of small sample populations to different frequencies and intensities of noise under specific circumstances.[7] These are used to anticipate reaction to noise. But human adaptability is well known. Fortunately for his emotional stability and physical survival, man can adjust to a wide range of conditions occurring in the real world.[8] Psychology tells us, however, that this adaptation takes its toll in the unconscious realm of the human mental-nervous system. Precisely how and to what extent noise affects us in this unrecognized way is not yet clear. But there is reason to expect that monitoring physiological and psychological responses during human sleep will confirm the unconsciously disruptive effects of noise.[9] In the meantime, psychology and psychiatry seem unanimous in their opinion that noise is registered by and affects the unconscious mind and central nervous system as an irritant or disruptively in some other way. These unconscious effects--together with the necessary human adjustment to unwanted conditions, reluctance to complain, not bothering to object because it is believed useless, or general distrust of the governmental establishment--are why registered complaints are not a reliable basis for determining desirable environmental conditions.

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[4] Alexander Cohen, "Physiological and Psychological Effects of Noise on Man," *Boston Society of Civil Engineers* (1965): 70-95; Alexander Cohen, Joseph R. Anticaglia, and Herbert Jones, "Noise Induced Hearing Loss-Exposures to Steady-State Noise," and Aram Glorig, "Medical Aspects of Noise Control," "Non-Auditory Health Effects," in *Proceedings of the Sixth Congress on Environmental Health* (Chicago: American Medical Association, April 1969); W. I. Acton, "A Review of Hearing Damage Risk Criteria," *Annals of Occupational Hygiene* (Great Britain) 10 (1967): 143-153; Anonymous, "How Today's Noise Hurts Mind and Body," *Medical World News*, 13 June 1969, pp. 42-47.

[5] W. Dixon Ward and James E. Fricke, eds., *Noise As a Public Health Hazard*, Proceedings of the Conference, 13-14 June 1968 (Washington, D.C.: American Speech and Hearing Association, February 1969), 384 pp.

[6] Karl D. Kryter, "Psychological Reactions to Aircraft Noise," *Science*, 151 (18 March 1966): 1340-56; I. Abey-Wickrama, M. F. A'Brook, F. E. G. Gattoni, and C. F. Herridge, "Mental Hospital Admissions and Aircraft Noise," *The Lancet*, 13 December 1969.

[7] James H. Botsford, "Using Sound Levels to Gauge Human Response to Noise," *Sound and Vibration* (October 1969): 16-28.

[8] Rene Dubos, *Man Adapting* (New Haven, Conn.: Yale University Press, 1965), 527 pp.

[9] Jerome S. Lukas, "The Effects of Simulated Sonic Booms and Jet Flyover Noise on Human Sleep," *Proceedings of the Sixth Congress on Environmental Health* (April 1969), 24 pp.

Noise, Economics, and Cities

Noise is prevented and reduced only at an economic cost.[10] No pollution control is "free." The cost-benefit ratio of noise abatement, however, is more favorable than water and air pollution alleviation because noise does not involve such huge fixed investments and improvement drawn out over a great many years. Mufflers for vehicular and stationary internal-combustion engines are not costly and do not reduce power output severely. Many noise sources are insulated without great expense.[11] Even aircraft-engine noise is being reduced by design improvements resulting from belated research and development. Every noice is lessened by reducing the power producing it. On the other hand, equipment to monitor and inspect sources of sound costs money. And for some forms of noise, such as sonic boom and helicopter rotor-slap, there is no economically feasible solution at present.

Although the benefits of noise control to human health and efficiency are difficult to calculate, there seems little doubt among those best informed that they are considerable.[12] Physical damage to hearing is shown in medical records and compensation awards in insurance and court records. Evidence exists suggesting that efficiency is reduced in working environments with excessive noise levels.[13] The mass effect of noise on people's tensions and "peace of mind," however, has not yet been measured nor its economic cost estimated. In suits for damage from environmental pollution, the courts have so far tended to take the view of economic balance, weighing the value of the noise source as a productive asset, taxable enterprise, and employer in the economy against the demonstrable damage done the plaintiffs.[14] With the current costs and potential dangers of environmental pollution becoming more and more apparent, it is likely that the courts will tend to equalize the burden of proof required of defendant and plaintiff.

Although the time left for preventive action is short, it is still possible to prevent noise pollution rather than have to cure it in the future. It is still a situation where advance planning can be accomplished as the word and process signify, rather than the action after the fact, to mitigate a condition already out of control, which is all too often characteristic of city planning in the United States today. What is done about present and potential urban environmental noise pollution is a test whether we have the will, capacity, and institutional mechanisms to plan in reality--or whether planning for a nation, state, region, or municipality is in fact more a comforting delusion than a true capability.

Noise and City Planning

Until recently, noise pollution was considered beyond the scope of city planning--

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[10] Edwin L. Dale, Jr., "The Economics of Pollution," *New York Times Magazine*, pt. 1, sec. 6, Sunday, 19 April 1970, pp. 27-29, 40, 42, 44, 47.

[11] Bolt, Beranek, and Newman, Inc., *A Study--Insulating Houses from Aircraft Noise* (Washington, D. C.: Government Printing Office, November 1966), 78 pp.

[12] U. S. House of Representatives, Subcommittee on Science, Research and Development, Committee on Science Astronautics, *Hearings: Environmental Quality--H.R. 7796, H.R. 13233, H.R. 14605, H.R. 14627*(Washington, D. C.: Government Printing Office, 1968), 588 pp., and *Managing the Environment*, Committee Print (Washington, D.C.: Government Printing Office, 1968), 59 pp.

[13] Alexander Cohen, "Noise Effects on Health, Productivity, and Well-Being," *Transactions of the New York Academy of Sciences*, 2d ser.30, no. 7 (May 1968): 910-18.

[14] Luther J. Carter, "Conservation Law I: Seeking a Breakthrough in the Courts," *Science* 166, no. 3912 (19 December 1969): 1487-91.

if it was considered at all.[15] With the advent of comprehensive city planning, no problem is excluded from consideration if it is important to the community and its future. Specifically, noise is involved in city planning because it affects human health and amenity through the design and construction of buildings and by the livability of the outdoor environment--the latter the focus of this article.

If industrial structures are built without regard to noise, human health may be damaged, as already indicated. If apartment buildings are constructed without acoustical insulation between dwelling units, not only are reasonable privacy and quiet violated but psychological irritation and strain can result. Also, as apartments are found undesirable because of noise transmission within the building, tenant turnover and poor maintenance are likely to increase. Similar effects occur when single-family homes are subject to excessive outside noise. In both cases, deterioration of the property is hastened. This, in turn, adds to other neighboring conditions favoring progressive economic decline and blighting of the area. Acoustical requirements of building design and construction belong in municipal building codes and state industrial public-health statutes requiring safe and healthful living and working environments. Although they are not considered here, they are essential to controlling noise pollution within the urban environment.

Any noise which permeates a neighboring area or entire district affects amenity and hence land use. A freeway which causes high-noise levels on adjoining property influences the type of land use which locates in this borderland or the design and acoustical insulation of buildings to attain necessary or desirable interior sound levels. Similarly, the high-noise level of diesel-truck traffic on a secondary highway or local street bordered by residential buildings will affect amenity and induce land use changes sooner or later. Airports, heliports and helistops, vertical and short-run takeoff and landing fields, and other facilities with exceptionally intense noise have even more pronounced effects on their immediate surroundings.[16] And as aircraft of various kinds multiply over cities, entire urban environments are subject to noise pollution which not only produces the adverse effects already mentioned but can impair the economic "health" and development potential of an entire city by generally reducing its desirability as a place to live.[17]

Urban Noise

Noise phenomena involve three components: a souce or noise generator, a transmission path, and a receiver. All methods of noise control intervene directly or indirectly with one or more of these components to change the noise situation. The source can be altered, the distance between source and receiver increased, or the receiver insulated. The receiver can be shielded from the noise source; transmission modified by changing the vibration frequency of the source, isolating vibrating elements, or increasing the distance between source and receiver; or the receiver can be altered by various means from ear plugs to different land use.

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[15] Dorn C. McGrath, Jr., "City Planning and Noise," in *Noise As a Public Health Hazard*, eds. Ward and Fricke, pp. 347-59.

[16] Bolt, Beranek, and Newman, Inc., *Estimated Noise Exposure Due to Helicopter Operations from Proposed Helistops in Century City*, Mimeographed report 1385, Job 163515 (Van Nuys, Cal., 15808 Wyandotte St., 91303: 5 August 1966), 16 pp.; Benjamin F. L. Darden, and M. I. Khan, "Developing a STOLport Policy for the City-Center," *Proceedings of the Eleventh Anglo-American Aeronautical Conference* (London, England: September 1969), 12 pp.

[17] Melville C. Branch, "Urban Planning and the New Mobility," *Journal of the American Institute of Planners* 30, no. 1 (February 1964): 2-9; Anthony James Catanese, "Helicopters and the Form of Future Cities, *Rotor & Wing* 1, no. 6: 38-42; Robert Courter, "What It's Like to Fly the New Jet Belt," *Popular Science* (November 1969): 55-59, 190; Jim Kissick, "Like Flight of a Bird," Pilot Report, *Rotor & Wing* 3, no. 5 (May 1969): 10-15, 37.

In the urban environment, ambient sound is the background level existing in the neighborhood or throughout the city. It is the accumulation of all the repeated natural and man-made sounds in a city, from crickets and bird calls to automobiles, aircraft, mechanical and construction equipment. It varies to a degree with different atmospheric conditions, topography, land use, and activity on the ground. Urban ambient sound can range from 40 dB(A) during the quietest hours of the early morning to as high as 80 in the noisiest part of the day. Although it appears to have halted its annual rise of 1 dB(A), growing noise from aircraft and new types of powered equipment threatens to increase ambient noise once again.

Vehicular surface traffic is the foremost noise pollutant in most cities.[18] It is the disturbing noise of the diesel truck which offends the ears of the largest number of the urban population. Other trucks, motorcycles, minicycles, and improperly mufflered or defective vehicles of every sort produce objectionable noise. In addition to the close-range effects of noisy vehicles, there is the bordering "roar" of heavily traveled freeways which creates corridors of background noise over and above the ambient sound level. Furthermore, unlike general urban ambient sound, the noise of an expressway is most noticeable at night when the rest of the city is quieter. Special-purpose vehicles with noisy attachments seem to be on the increase, such as trucks carrying un-shielded gasoline engines for power purposes, air compressors, or the pulverizing machinery for tree prunings which produces very intense high-frequency noise. The snowmobile and beach buggy are bringing noise pollution to some communities, as well as to the quiet countryside. . . .

Unless checked, aircraft will likely become the most pervasive and disturbing source of urban noice in the future.[19] In areas surrounding airports, aircraft landings and takeoffs, taxiing, and testing engines on the ground generate the most intense noise in the city.[20] These areas are growing. In metropolitan Los Angeles, for example, 5 percent of the urbanized area projected for 1990 will lie within the 88 dB(A) noise contour surrounding the 20 airports expected at this future time. From these airfields there will be many more than the three million takeoffs and landings in the Los Angeles area in 1959. It is difficult to imagine, however, that there will be more than the four billion dollars of suits involving noise now outstanding around Los Angeles International Airport. Twenty years from now, there will probably be many more than the 165 heliports and helistops now existing, and as many VTOL and STOL ports with their especially noisy aircraft as proponents can attain. The situation will be worse in the larger urban centers, but smaller communities will also have more noise and related problems.

Of even greater import for urban environment in the future is the rapidly increasing number of aircraft over cities. In los Angeles, this now includes more commercial airline routes and more frequent flights, more business aircraft, personal flights, police and fire helicopter patrols, the overflight of military helicopters based at military airfields in Southern California, and more and more miscellaneous helicopter flights transporting business executives, politicians, movie actors, municipal officials, newscasters, data-processing tapes, construction materials. It is now proposed that they be used for regular ambulance service. To these flights will be added, if present intentions are realized, extensive VTOL and STOL commercial operations in and out of the city.[21] Not to be dismissed as purely imaginary is the possibility of personal helicopter flying and jet back-packs for individual locomotion in the air. Kits have been available for some years permitting the buyer to assemble his own single-place autocopter. Until recently, the jet backpack was powered by a blast of compressed air, but a small jet turbine now provides much longer flight. . . .[22]

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[18] Karl D. Kryter, "Evaluation of Transportation Noise," *Proceedings of the Sixth Congress on Environmental Health* (April 1969), 16 pp.; Consultative Group on Transportation Research (B.T. Price, Chairman), *Urban Traffic Noise--Strategy for an Improved Environment* (Paris, France: Organization for Economic Cooperation and Development, August 1970), 141 pp.; Richard C. Potter, *Transportation Noise Sources*, Presented at the Thirty-sixth Convention of the Audio Engineering Society (New York: April 1969), 21 pp.

[19] O. Powers, "Airport Noise: An Environmental Problem," *Proceedings of the Fifteenth Annual Technical Meeting* (New York: Institute of Environmental Sciences, April 1969), pp. 215-30.

[20] Jack McCurdy, "Hazards, Noise Around Airport Will Close Second School," *Los Angeles Times*, 18 July 1969, p. 1.

The third category of urban noise comprises such varied sources as: construction equipment, particularly jackhammers, air compressors, concrete-mixing and riveting machines; air-conditioning blowers on building rooftops; outdoor vacuum-cleaning machines; lawn mowers, chain-saws, and other tools and toys powered by gasoline engines; car-washes; automobile crushing and pelletizing; outboard-motor boats; and exterior loud-speaker systems. This miscellaneous category of noisemakers in the urban scene appears to be growing as urban densities and the standard of living rise, and as leisure time and recreational activities increase.

Noise Control: Freeways, Ground Vehicles and Powered Equipment

Engine Noise

First, it must be determined if new legislation with stricter standards for mufflers, engine enclosure, and tire design is needed on original truck, bus, motorcycle, passenger car, and other ground vehicles before they can be sold within the municipality. At the same time, police patrol cars must be equipped with sound meters permitting the monitoring and control of vehicular noise in accordance with urbanwide limits. Stockholm has had such acoustical patrolling for years. In particular, the louder noise of fourthhand and poorly maintained cars must be controlled, even if this means a long-term public loan or subsidy for the low-income owner who cannot pay for the repair required to reduce the noise from his car and has no alternative to its use for his gainful employment. Fines for violations must be high enough to definitely deter disregard of noise-control regulations.

Insulation

If not already existing, construction standards should be established which provide the occupants of buildings along noisy transportation corridors with reasonable protection against this environmental impairment, except where topographical defilade of a permanent nature screens out the transmission of noise from highway or rail traffic. These acoustical insulation standards and their enforcement would be the responsibility of the municipal department with jurisdiction over the building code. With the sound insulation of roofs added, these same regulations might be required as the minima for new construction in areas surrounding airports.

Screening

Exterior screening or buffering is also effective in certain environmental noise situations. Fences, walls, or earth mounds along the right-of-way boundaries of automobile expressways can sometimes protect adjacent single-story dwellings from most of the expressway noise. Dense rows of trees or large shrubs planted at freeway borders can reduce noise by about 1 decibel for every 4 feet of thickness, as well as cut off direct view of traffic, reduce the glare from automobile lights at night, and mitigate smog and exhaust fumes slightly. Autobahns in West Germany are frequently lined with trees. High acoustical screens of wood or masonry, made as visually pleasing as feasible, may be worth while where an activity such as an open-air amphitheater, auditorium, or otherwise tranquil pocket park is subject to freeway roar. Such buffers would be installed and maintained by the state department of highways or its equivalent or by whatever agency controlled the auditorium, park, or facility needing noise protection.[23]

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[21] Charles Einstein, "There's a STOL in Your Future," *Los Angeles Times*, West Magazine, 10 August 1969, pp. 8-12; Bruce Ellison, "STOL, The Coming Invasion of America," *Rotor & Wing* 4, no. 11 (November/December 1970): 22-25, 32-33.

[22] See above footnote 17.

Subdivision, Project, and Building Design

Noise is reduced by an arrangement of single-family dwellings on land alongside a freeway which: "backs up" lots to the expressway; places houses as far forward on these lots as feasible to increase distance from the freeway; provides for garages, a masonry fence, and/or dense landscaping as a screen between the house and the expressway; and uses house plans which locate those functions within the home least disrupted by noise, closest to the freeway and also possibly with an insulated wall with no windows facing the freeway. Similarly, in project design, the operations least disturbed by vehicular noise may be placed closest to the transportation artery, and in such a way that they screen other activities more sensitive to vehicular noise. For example, for some industrial and commercial activities, warehousing and other storage facilities can be interposed as an effective barrier between the noise source and areas or functions to be protected. Of course, distance itself reduces sound; doubling the distance from a noise source reduces its intensity approximately 6 dB(A).

Land Use

Another way of controlling the effects of freeway noise is regulating the land use permitted or encouraged on bordering property. If it were feasible to limit this to open space, there would be far fewer people, of course, subject to freeway roar. But cities cannot do without the tax revenues from what would be a significant percentage of the most accessible urban land, and they would have to withstand year after year the age-old pressures for intense land use next to principal highways. With good subdivision, project, and building design as described briefly above, freeway noise need not preclude the location close by of any but the most noise-sensitive land uses. Clearly, residential land uses will in general require high development standards to insure that dwelling units are not made undesirable and thereby progressively deteriorated by the noise from the nearby traffic artery. Probably industrial land use suffers the fewest ill effects of location next to an expressway. It can most easily afford adequate insulation, part of which may be required by industrial health standards for noise levels inside the building. On the average, fewer people are involved than for multiple-story commercial or apartment concentrations. And the industrial project can often be designed so that noise-insensitive areas screen spaces either occupied by people or industrially sensitive to noise.

Powered Equipment

There must be acoustical limitations in the municipal building code for air-conditioning units unenclosed or insufficiently insulated, for automatic car-washes, and other mechanical equipment which produces excessive noise for nearby dwelling units. Building inspectors, in the course of inspection for other purposes, can sample check various installations with respect to noise, and investigate noise violations. Sale of equipment which is designed without regard to noise--such as some gasoline-powered lawnmowers, minicycles, and power tools--should be prohibited within the municipality. For if noise-polluting sources are allowed to be sold and to multiply throughout the city, the difficulty of quietening them later is magnified. An example of such a potential source is the gas turbine engine now being promoted for power generation. While it contributes less to smog than do gasoline engines, it could add appreciably to noise pollution. The municipal departments responsible for controlling noise pollution by powered equipment are those empowered to prohibit the sale of products which do not meet municipal standards of health, safety, and amenity, and those responsible for the inspection of buildings and their equipment.

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[23] John J. Beaton, and Louis Bourget, *Can Noise Radiation From Highways Be Reduced by Design?* Highway Research Report No. M&R 636316-1 (Sacramento, Cal.: Materials and Research Department, Division of Highways, Department of Public Works, Highway Transportation Agency, January 1968), 28 pp. Paper.

Noise Control: Airports, Aircraft, and Airways

Aircraft

Prevention of aircraft noise pollution involves the same general elements of control as for vehicles: the noise source and its location on the ground or in the air; land use; building insulation; screening; and subdivision and project design. Until recently, aircraft-engine manufacturers paid little attention to reducing the sound levels of these primary sources of outdoor noise pollution. The U.S. Federal Aviation Administration (F.A.A.) has recently reduced permissible noise levels of new aircraft engines, but the new levels are well above what can be tolerated around airports from the viewpoint of environmental city planning. Nor has the federal government announced a definite policy with respect to the forthcoming sonic booms of supersonic aircraft.[24] Procrastination and irresolution are the order of the environmental day.

Local governments must take whatever actions they can to prevent aircraft-noise pollution and constantly pressure higher levels of government to find the courage to act. For it is the local government which suffers directly from rising aircraft noise, and it is the municipality which may have its economic as well as environmental health hurt by noise pollution. The fact that the federal government has legal jurisdiction over the airways above an indefinite height over the ground should not deter municipalities from establishing firm control over the immediate air environment--except the approach, landing, and take-off paths to F.A.A. certified airports. Without this control of its environmental "third dimension," a city cannot prevent the fouling of its own nest by federal inaction or error.[25] The best such protection is reducing aircraft-engine noise at the source. If airlines know that they will be heavily fined after every landing if their aircraft does not meet municipal noise requirements, they will certainly seek alternate airplanes or routes. If these standards cannot be met, introduction of new aircraft into the community should wait until technological advances make this possible.[26]

Airports and Airways

All too often, cities have allowed airports to expand and bring severe noise pollution to surrounding developments originally some distance away. Or cities have permitted building up to airport property lines, with little or no protection from aircraft noise. Resulting questions of environmental responsibility and liability will be settled sooner or later in the courts, as numerous lawsuits are decided. The critical requirement at present is to install automatic sound-monitoring at airport property lines to enforce noise limits established for aircraft approaching, landing, taxiing, taking off, and testing engines. But . . . the noise from aircraft spreads far beyond the vicinity of airports. More and more airways extend over the larger cities as the aircraft and airline industries strive to create a bigger and bigger demand for air travel. This urban overflight and overhead noise have been ignored or avoided. For example, a high official of the Western Regional Office of the F.A.A. is quoted to agree that this federal office has not been taking into account in planning air routes their noise effects on metropolitan Los Angeles. He is reported to concur that higher altitudes for flights returning eastward over land after takeoff westward over the Pacific Ocean, would reduce the noise of these overflights in the city.[27] It is a mistake for a municipality to depend on someone else to establish noise limits it requires for its own environmental protection. And its urbanwide noise-monitoring system must extend well beyond airport property lines.

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[24] Carl D. Kryter, "Sonic Booms from Supersonic Transport," *Science* 163, no. 24 (January 1969): 359-67; George Muscone, "The SST and the California Environment: Bangs and Superbangs," *Cry California* 4, no. 1 (Winter 1968-69): 5-11.

[25] Ray Donley, "Community Noise Regulation," *Sound and Vibration* (February 1969): 12-21.

[26] Committee on Public Engineering Policy, National Academy of Engineering, "Experimental Technology Assessments, Subsonic Aircraft Noise," in *A Study of Technology Assessment* (Washington, D.C.: Superintendent of Documents, July 1969), pp. 76-95.

Land Use

The F.A.A. has been encouraging industrial and commercial use of land subject to the most intense noise not only at both ends of airport runways but more generally surrounding airports. The point is made that around a busy, noisy, industrial-type land use such as a major airport is no place for adjacent residential development needing and expecting reasonable neighborhood peace and quiet. Schools may not be able to conduct classes; libraries and some medical offices could also be badly affected. The most difficult situations exist where major airports are bordered by residential areas with no open space or other deliberate land use buffer in between. Yet today there are new residential properties being crowded close to active, noisy, and growing airports, without special acoustical provisions or subdivision design to reduce the impact of aircraft noise. Certainly, this should not be possible, for we know from long experience how overoptimistic or undiscerning homebuyers can be in making what is usually the biggest investment of their lives. Sometimes they are deliberately misled.

There have developed over the past 25 years or so other land use dynamics around urban airports.[28] The first to come, wanting to locate on bordering property, were industrial activities closely related to airplanes. Then came other industries whose products required fast shipment by air. These were followed by businesses requiring a continuous flow of people from far and wide who wished to come and go as quickly as possible. This led to hotels, restaurants, and other directly supportive commercial land use nearby. And, finally, as airports grow and become large employment centers in themselves, they generate additional commercial needs such as businesses closely connected with airport operations and activities, and shopping and services used by airport employees near their place of work.

That there is development pressure to crowd industrial and commercial land used close to airports is self-evident. The critical question is whether this cycle of development should be as uncontrolled as the earlier residential subdivision which led to environmental deterioration and lawsuits for damages. This in turn relates to two other key questions. Will the very severe traffic congestion which exists on the ground around most airports today slowly but surely depress industry and commerce crowded too close? And, even if building interiors are acoustically protected, will the fact that *outdoor* noise from aircraft will be so pervasive in the future make a difference in land use demand and development around airports? At the busiest airports, aircraft are expected to be taking off or landing less than every 15 seconds on the average. These are basic questions of city planning, best determined for each particular situation. For example, airports can screen themselves off to a degree by locating buildings along the edge of their property between a runway and bordering residences. Masonry walls along the property line, together with a thick border of trees, can do much to screen noise generated on the ground within airports and hide from adjacent view what is becoming more and more an industrial operation characterized as much by grime, grit, and fumes as cacophony of sound.

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[27] Larry Levine, "Action on Plain Noise Protests," *Beverly Hills Citizen*, 8 January 1970, p. 1.

[28] Arde, Inc. and Town and City, Inc., *A Study of the Optimum Use of Land Exposed to Aircraft Landing and Takeoff Noise*, NASA Contractor Report CR-410, Prepared under Contract NAS 1-3697 for Langley research Center (Washington, D. C.: National Aeronautics and Space Administration, March 1966), 140 pp.; Michael J. Meshenberg, *Planning the Airport Environment*, Planning Advisory Service Report No. 231 (Chicago, Ill.: American Society of Planning Officials, February 1968), 38 pp.

For new airports, new communities, and existing airfields slated for growth but now surrounded by undeveloped land, the highest degree of forethought, continuous master planning, and land use control must be applied. First and foremost, while the land is still free of urban structures, a surrounding buffer of open land large enough to include the area subject to aircraft-noise pollution should be bought, land development rights purchased, or otherwise absolutely controlled against any but approved and time-limited land use which have relieved the airport and municipality from all noise liability. These protective noise belts can be used for agriculture, recreational activities involving few people, trafficways, and parking places. Expansion of the airport beyond its planned capacity and area limits is not allowed, unless technological advances permit intensification or extension without impairment of the surrounding environment.

Monitoring and Analysis

Controlling outdoor noise pollution requires a set of permissible limits and their measurements for a variety of existing and potential sources. It also requires the simplest workable method of measurement, for the success of local laws depends on voluntary compliance and reporting of violations by the citizenry. Sample check on compliance is all that can be afforded without prohibitive municipal costs. The A-Scale or dB(A) measurement of sound most closely fits these essential requirements. It most nearly approximates human hearing and reaction to sound. It is understandable to the average person. It involves no transformation calculations. A-Scale readings are readily converted into approximate PNdB and several other sound measurement scales. And A-Scale sound meters are less expensive than other types.[29]

Sound meters in police cars and at stationary locations along trafficways are the direct way of enforcing noise limits for automotive vehicles and powered equipment. Noise readings can be added to random or regular inspection of automobile brakes, lights, and other safety equipment. And, in some cities, noise meters could be added to vehicles used for air-pollution inspection. It would certainly be appropriate to observe noise as well as chemical pollution of the urban air. Control of aircraft noise overhead requires an Environmental Air Traffic Controller in the radar control center of the major metropolitan airport. The controller's sole responsibility would be to monitor compliance with air-traffic routes and altitudes established to reduce noise, to identify and report all violations, and to recommend continued improvement of the system. A licensing or inspection agency of municipal government must also check by random sampling whether vehicles, aircraft, powered equipment, and other manufactured products meet urban environmental noise standards. Because complete inspection is impractical and prohibitively costly, an urbanwide system of noise reporting and recording is most desirable. There is a possible basis for this system in the telephone network extending throughout the city. It should be possible to phone a noise control and and information center to report and acoustically record a sound believed to be above permissible limits. The record of citizen reports and noise-patrol reports, sound frequencies and intensities as transmitted by the telephone system, and results of specific inspections could be analyzed for: the predominant kinds of outdoor noise; persistent problems and violations; correlations with land economic condition of a business or industry; trends in the types and intensities of exterior noise; and any urban-wide patterns revealed in the accumulated data. It should also be possible to identify new sources of noise as reports accumulate. . . .

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[29] Harold M. Frederickson, "Noise Control on the Local Level," *Proceedings of the Sixth Conference on Environmental Health* (April 1969), 10 pp.: Division of Applied Physics, National Research Council of Canada, *A Brief Study of a Rational Approach to Legislative Control of Noise* (Ottawa, Ontario, 1968), 40 pp.

Conclusions and Recommendations

Legislation. Enact laws limiting man-made noise in the outdoor urban environment; license the sale locally of products presently or potentially noisy; establish responsibility for noise emission and control; create an office within municipal government to take the lead locally in the abatement and prevention of noise pollution; provide mandatory notice to home buyers when their dwelling is in an existing or potential area of noise pollution; set acoustical insulation standards for new apartments throughout the city and new single-family houses in designated areas.

Planning and Operations. Appoint an Environmental Air Traffic Controller to monitor air-traffic routes over the city and control overhead aircraft noise; equip ground patrol vehicles with sound meters to monitor ground noise; install sound recorders at airports and elsewhere in the municipality to monitor air-traffic noise; plan municipal facilities of every type so that they either meet or better noise standards; formally consider noise in subdivision, land use, and city planning; institute a municipal purchasing policy requiring bidders to meet municipal noise standards.

Information and Analysis. Establish a city system for gathering and analyzing noise information.

Advocacy. Pressure federal and state governments to adopt and accept new and stricter limits for noise emission in metropolitan environments; urge manufacturers to make products with low noise emission.

Muskegon County, Michigan, Mends Waste Lands with Waste Water

Can county government effectively deal with problems of environmental pollution? The reapportioned Muskegon County, Mich., Board of Commissioners says *yes* and they have the program to prove it. The Muskegon County Waste-water Management Plan developed under the direction of the Board has been referred to by President Richard M. Nixon as an "innovative system of water-borne waste disposal. . . . a new and promising approach to sewage disposal."

Familiarity with this pioneering effort can provide direction for other counties faced with problems of environmental degradation. Also, the Muskegon County experience can serve to encourage county officials who are reluctant to undertake the formulation of county wide wastewater systems because of the risk of failure.

To best appreciate the Muskegon County plan, it is necessary to have an understanding of the three distinct stages that made up the *planning process* which resulted in the plan. The first stage involved the undertaking of a water-resources policy study. The primary purpose of this study was to provide a policy framework for specific water and sewer plans which were to be prepared. The second stage was directed toward the formulation of a waste-water management plan. This plan was designed to be a total solution, both in terms of area (joining the incorporated and unincorporated areas together) and treatment (no direct discharge of any wastes into any water course). The final stage involved the implementation of the plan. In essence, the implementation required the functional consolidation of all waste water management activities in the county.

An important aspect of the planning process relates to the people involved. Although the County Board is made up of 9 Democrats and 6 Republicans, the Board approached the subject on a non-partisan basis. Harmony reigned throughout the planning process; the Board members knew they had a job to do and they joined together to do it. The Economic Development Commission (Planning Commission) under the leadership of its chairman, Michael Kobza, spent countless hours in the policy background, formulation, and implementation stages of the plan. Of particular importance to the effort were the professionals who supported the elected officials. County Administrator Ray S. Wells, and Planning Director R. T. Dittmer, were the principal staff members associated with the plan. Based on the Muskegon County experience, it appears that competent professionals in county government are a prerequisite for success.

Policy Study and Research

The undertaking of a policy study was the idea of the county planning director. In this study, relevant interests were identified as a prelude to the establishment of a broad base of understanding of future plans. In addition, information on goals, problems, and management alternatives was obtained to provide planning guidelines. This information was gathered through personal interviews with representatives from all sectors of the community, from an examination of published reports and planning documents, and by an evaluation of on-going programs and development decisions.

This article originally appeared in *The American County*, Volume 35, No. 8, August 1970. Pp 32-35. Reprinted by permission.

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The overall general development goals for Muskegon County which had the strongest support were: (1) consolidation of governments and related services, and (2) economic development (regional).

With respect to a water-resource management policy, the goals most desired were: (1) improvement of environmental quality, (2) provision of an adequate water supply for all needs, and (3) expansion of recreation opportunities.

The high degree of compatibility between the overall general development goals and the water-resource management goals made it possible to use water management as a basic planning device. The attainment of water management goals will to a large measure help to attain general development goals. In this light, water is a subsystem of a larger urban system and can assist the county in the realization of its goals and aspirations.

An analysis of the problems confronting the county showed that the economic woes were due, in part, to a failure to capitalize on the recreational resource potential and to develop an agricultural base. The cause for the low agriculture input is the low fertility of the soil. These two employment deficiencies--service industry and agriculture--can be linked together and related to issues of environmental quality.

The provision of sewerage systems for the urbanized areas and more complete treatment of municipal and industrial wastes ranked highest in terms of acceptability of management alternatives. An assessment was made of the physical environment to identify potential resources that could be related to a plan. This approach made it possible to identify the forces in nature as opportunities that could be capitalized upon in the plan.

The policy study proved to be highly successful and provided meaningful guidelines for use in the formulation of a waste-water management plan. It also served to assist in the subsequent development of other needed planning activities.

The Plan and Three Fundamentals

The plan formulated constituted a synthesis of goals, problems, and management opportunities. In essence, the waste-water management plan had the potential to improve the environmental quality and also be the key to the expansion of recreational and agricultural opportunities. Partially treated waste-water discharged into Mona, Muskegon, and White Lakes was accelerating eutrophication (enrichment) of the water. Nutrients--nitrates, phosphates, and potassium--dissolved in wastewater are the very items needed to make the unproductive soils productive. If the nutrients were taken inland instead of being discharged into the water, the environmental quality would improve because of the elimination of waste discharges; in turn, the opportunity for the development of water-oriented recreation would be enhanced and an agricultural potential developed.

The Muskegon County plan recognizes three fundamental principles. First, the earth is a unit. We can no longer dispose of wastes by passing them from one area to another on this earth. There are no "disposal" areas which will not come back to haunt us, or our children, or our children's children. Second, pollutants are simply resources out of place. The basic nutrients and minerals in industrial and municipal wastes now entering our rivers and lakes cause excessive vegetation to grow in those bodies of water, resulting in the rapid aging and premature death of our precious water resources. We must see that these nutrients and minerals are utilized in such a manner that they cause desirable vegetation to grow where we want it to grow--on agricultural and forest lands. And third, we must recycle our basic resources if man is to survive on this planet under conditions acceptable to human beings. We must use our basic nutrients and minerals over and over again rather than dispose of them wastefully.

Collection, Treatment, Irrigation

The basic components of the plan are (1) a collection system and transport pipeline, (2) treatment lagoons, (3) an irrigation site, and (4) a system to apply the waste water (irrigation system). The system functions in the following manner.

A pipeline is used to transport all of the wastes from the urbanized part of the county to a site that environmental geologic studies have shown to be safe for the operation of waste-water management programs. A series of treatment lagoons are constructed at the site that provide for aeration and aerobic bacteria to satisfy biochemical oxygen demand (BOD), settling to remove settleable solids, and sunlight to convert some nitrates and phosphates into algal cell material which can be more readily retained by the soil. The lagoon treatment facility produces an effluent superior to that of a secondary sewage treatment plan (activated sludge) by substituting time for sludge accumulation.

The lagoon treatment facility offers several distinct advantages over traditional treatment. First, large amounts of storage can be provided in the treatment lagoon to hold and treat unusually large flows of water generally associated with storm-water runoff and combined sewer overflow. Second, because of the large volume of water held in the lagoon treatment facility, it has the capacity to assimilate toxic shock loads associated with industrial spills. Even if the bacterial colony is killed off by the toxic material, the incoming wastes are stored until another colony can be established. This is quite different from an activated sludge plant, where a colony kill results in the discharge of partially-treated wastes for 7 to 10 days until a new colony is established. An analysis of a large activated sludge plant in the midwest showed that such colony kills are likely to occur as frequently as six times per year.

Another advantage is the effect of lagoons in terms of virus removal. Research has shown that after 30 days' detention in a lagoon, only 30 percent of the samples analyzed for 13 viruses were positive, whereas all samples were positive after secondary treatment in an activated sludge plant.

Returning Vitals to the Earth

After the waste water is treated in the lagoon system, it is disinfected by chlorination and is applied to geologically-suited land areas which provide tertiary treatment through the biological zone of the soil--appropriately named the *living filter*. In Muskegon County, these areas tend to be glacial outwash plains which are unproductive because they lack water-holding capabilities and nutrients. By applying the treated waste-water on these sites, both of the missing ingredients are provided and the barren land will become productive. The method of application involves large automated rotating spray irrigation rigs which cover 160 acres from a central point. These rigs require low labor inputs to operate and will produce little, if any, aerosol or drift effect. Because the pipe rotates around the field, the water does not have to be projected high into the air to gain coverage.

The harvesting of animal feed crops from the irrigation site completes the treatment process. The nutrients in the waste water are harvested and, in addition, heavy metals in the waste water are held by organic matter and clay particles in the soil, and some are taken up as trace elements by the plants. The waste water, after purification in the lagoons and treatment by the living filter, moves to the ground-water table where it is discharged as base flow to water courses to augment low flow or is recharged to the ground-water resource.

Waste Water for Farmlands

The plan will be creating a new agricultural industry in Muskegon County which will help the local economy in a significant way. It will constructively utilize resources which are wasted today, by converting them to agriculture crops rather than water weeds and algae. . . .

When the waste-water management plan was presented to the reapportioned County Board of Commissioners, it was unanimously adopted as the official county plan. Furthermore, upon presentation of the plan by County Administrator Ray S. Wells, to all the local government units and key industries, similar unanimous responses were obtained. U. S. Congressman Guy Vander Jagt observed that because of "the magnificent cooperation of local units of government, the unsurpassed leadership of Muskegon County officials, the tremendous response from the Federal Water Quality Administration and the President's Council on Environmental Quality, along with the approval by the State of Michigan, I will predict that the Muskegon County facility will be the focal point for the Nation's battle to solve water pollution problems." Furthermore, the Congressman referred to the program as ". . . a grand and glorious vision that would permit us to put water back into our lakes and rivers that would be as pure as when the white man first saw them."

Muskegon County and all of western Michigan stand to benefit immensely from this visionary effort to bring a sound approach to the solution of water pollution problems. Those citizens who have so long fought the seemingly hopeless battles against the contamination of our environment are about to win a significant and far reaching victory in Muskegon County. . . .

Just v. Marinette County

Shorelands for the purpose of ordinances are defined in Sec. 59.971(1), Stats., as lands within 1,000 feet of the normal high-water elevation of navigable lakes, ponds, or flowages and 300 feet from a navigable river or stream or to the landward side of the flood plain, whichever distance is greater. The state shoreland program is unique. All county shoreland zoning ordinances must be approved by the department of natural resources prior to their becoming effective. . . . If a county does not enact a shoreland zoning ordinance which complies with the state's standards, the department of natural resources may enact such an ordinance for the county. Sec. 59.971(6), Stats.

[2] There can be no disagreement over the public purpose sought to be obtained by the ordinance. Its basic purpose is to protect navigable waters and the public rights therein from the degradation and deterioration which results from uncontrolled use and development of shorelands. In the Navigable Waters Protection Act, Sec. 144.26, the purpose of the state's shoreland regulation program is stated as being to "aid in the fulfillment of the state's role as trustee of its navigable waters and to promote public health, safety, convenience and general welfare."[1] In Sec. 59.971(1), which grants authority for shoreland zoning to counties, the same purposes are reaffirmed.[2] The Marinette county shoreland zoning ordinance in Secs. 1.2 and 1.3 states the uncontrolled use of shorelands and pollution of navigable waters of Marinette county adversely affect public health, safety, convenience, and general welfare and impair the tax base.

The shoreland zoning ordinance divides the shorelands of Marinette county into general purpose districts, general recreation districts, and conservancy districts. A "conservancy" district is required by the statutory minimum standards and is defined in Sec. 3.4 of the ordinance to include "all shorelands designated as swamps or marshes on the United States Geological Survey maps which have been designated

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The above has been excerpted from the *North Western Reporter* (201 N.W.2d 761).

[1] "144.26 Navigable waters protection law (1) To aid in the fulfillment of the state's role as trustee of its navigable waters and to promote public health, safety, convenience and general welfare, it is declared to be in the public interest to make studies, establish policies, make plans and authorize municipal shoreland zoning regulations for the efficient use, conservation, development and protection of this state's water resources. The regulations shall relate to lands under, abutting or lying close to navigable waters. The purposes of the regulations shall be to further the maintenance of safe and healthful conditions; prevent and control water pollution; protect spawning grounds, fish and aquatic life; control building sites, placement of structure and land uses and reserve shore cover and natural beauty . . ."

[2] "59.971 Zoning of shorelands on navigable waters (1) To effect the purposes of s. 144.26 and to promote the public health, safety and general welfare, counties may, by ordinance enacted separately from ordinances pursuant to s. 59.97, zone all lands (referred to herein as shorelands) in their unincorporated areas within the following distances from the normal high-water elevation of navigable waters as defined in s. 144.26(2)(d): 1,000 feet from a lake, pond or flowage; 300 feet from a river or stream or to the landward side of the flood plain, whichever distance is greater. If the navigable water is a glacial pothole lake, the distance shall be measured from the high water-mark thereof."

as the Shoreland Zoning Map of Marinette County, Wisconsin or on the detailed Insert Shoreland Zoning Maps." The ordinance provides for permitted uses[3] and conditional uses.[4] One of the conditional uses requiring a permit under Sec. 3.42(4) is the filling, drainage or dredging of wetlands according to the provisions of Sec. 5 of the ordinance. "Wetlands" are defined in Sec. 2.29 as "(a)reas where ground water is at or near the surface much of the year or where any segment of plant cover is deemed an aquatic according to N. C. Fassett's "Manual of Aquatic Plants." Section 5.42(2) of the ordinance requires a conditional-use permit for any filling or grading "Of any area which is within three hundred feet horizontal distance of a navigable water and which has surface drainage toward the water and on which there is: (a) Filling of more than five hundred square feet of any wetland which is contiguous to the water . . . (d) Filling or grading of more than 2,000 square feet on slopes of twelve percent or less."

In April of 1961, several years prior to the passage of this ordinance, the Justs purchased 36.4 acres of land in the town of Lake along the south shore of Lake Noquebay, a navigable lake in Marinette county. This land had a frontage of 1,266.7 feet on the lake and was purchased partially for personal use and partially for resale. During the years 1964, 1966, and 1967, the Justs made five sales of parcels having frontage and extending back from the lake some 600 feet, leaving the property involved in these suits. This property has a frontage of 366.7 feet and the south one-half contains a stand of cedar, pine, various hard woods, birch and red maple. The north one-half, closer to the lake, is barren of trees except immediately along the shore. The south three-fourths of this north one-half is populated with various plant grasses and vegetation including some plants which N. C. Fassett in his manual of aquatic plants has classified as "aquatic." There are also non-aquatic plants which grow upon the land. Along the shoreline there is a belt of trees. The shoreline is from one foot to 3.2 feet higher than the lake level and there is a narrow belt of higher land along the shore known as a "pressure ridge" or "ice heave," varying in width from one to three feet. South of this point, the natural level of the land ranges one to two feet above lake level. The land slopes generally toward the lake but has a slope less than twelve percent. No water flows onto the land from the lake, but there is some surface water which collects on land and stands in pools.

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[3] "3.41 Permitted Uses.

(1) Harvesting of any wild crop such as marsh hay, ferns, moss, wild rice, berries, tree fruits and tree seeds.

(2) Sustained yield forestry subject to the provisions of Section 5.0 relating to removal of shore cover.

(3) Utilities such as, but not restricted to, telephone, telegraph and power transmission lines.

(4) Hunting, fishing, preservation of scenic, historic and scientific areas and wildlife preserves.

(5) Non-resident buildings used solely in conjunction with raising water fowl, minnows, and other similar lowland animals, fowl or fish.

(6) Hiking trails and bridle paths.

(7) Accessory uses.

(8) Signs, subject to the restriction of Section 2.0."

[4] "3.42 Conditional Uses. The following uses are permitted upon issuance of a Conditional Use Permit as provided in Section 9.0 and issuance of a Department of Resource Development permit where required by Section 30.11, 30.12, 30.19, 30.195 and 31.05 of the Wisconsin Statutes.

(1) General farming provided farm animals shall be kept one hundred feet from any non-farm residence.

(2) Dams, power plants, flowages and ponds.

(3) Relocation of any water course.

(4) Filling, drainage or dredging of wetlands according to the provisions of Section 5.0 of this ordinance.

(5) Removal of top soil or peat.

(6) Cranberry bogs.

(7) Piers, docks, boathouses."

The land owned by the Justs is designated as swamps or marshes on the United States Geological Survey Map and is located within 1,000 feet of the normal high-water elevation of the lake. Thus, the property is included in a conservancy district, and, by Sec. 2.29 of the ordinance, classified as "wetlands." Consequently, in order to place more than 500 square feet of fill on this property, the Justs were required to obtain a conditional-use permit from the zoning administrator of the county and pay a fee of $20 or incur a forfeiture of $10 to $200 for each day of violation.

In February and March of 1968, six months after the ordinance became effective, Ronald Just, without securing a conditional-use permit, hauled 1,040 square yards of sand onto this property and filled an area approximately 20 feet wide commencing at the southwest corner and extending almost 600 feet north to the northwest corner near the shoreline, then easterly along the shoreline almost to the lot line. He stayed back from the pressure ridge about 20 feet. More than 500 square feet of this fill was upon wetlands located contiguous to the water and which had surface drainage toward the lake. The fill within 300 feet of the lake also was more than 2,000 square feet on a slope less than 12 percent. It is not seriously contended that the Justs did not violate the ordinance and the trial court correctly found a violation.

The real issue is whether the conservancy district provisions and the wetlands-filling restrictions are unconstitutional because they amount to a constructive taking of the Justs' land without compensation. Marinette county and the state of Wisconsin argue the restrictions of the conservancy district and wetlands provisions constitute a proper exercise of the police power of the state and do not so severely limit the use or depreciate the value of the land as to constitute a taking without compensation.

[3-8] To state the issue in more meaningful terms, it is a conflict between the public interest in stopping the despoilation of natural resources, which our citizens until recently have taken as inevitable and for granted, and an owner's asserted right to use his property as he wishes. The protection of public rights may be accomplished by the exercise of the police power unless the damage to the property owner is too great and amounts to a confiscation. The securing or taking of a benefit not presently enjoyed by the public for its use is obtained by the government through its power of eminent domain. The distinction between the exercise of the police power and condemnation has been said to be a matter of degree of damage to the property owner. In the valid exercise of the police power reasonably restricting the use of property, the damage suffered by the owner is said to be incidental. However, where the restriction is so great the landowner ought not to bear such a burden for the public good, the restriction has been held to be a constructive taking even though the actual use or forbidden use has not been transferred to the government so as to be a taking in the traditional sense. . . . Whether a taking has occurred depends upon whether "the restriction practically or substantially renders the land useless for all reasonable purposes." . . . The loss caused the individual must be weighed to determine if it is more than he should bear. As this court stated in *Stefan*, at pp. 369-370, 124 N.W.2d 319, p. 323, ". . . if the damage is such as to be suffered by many similarly situated and is in the nature of a restriction on the use to which land may be put and ought to be borne by the individual as a member of society for the good of the public safety, health or general welfare, it is said to be a reasonable exercise of the police power, but if the damage is so great to the individual that he ought not to bear it under contemporary standards, then courts are inclined to treat it as a 'taking' of the property or an unreasonable exercise of the police power."

[9] Many years ago, Professor Freund stated in his work on The Police Power, Sec. 511, at 546-547: "It may be said that the state takes property by eminent domain because it is useful to the public, and under the police power because it is harmful . . . From this results the difference between the power of eminent domain and the police power, that the former recognizes a right to compensation, while the latter on principle does not." Thus the necessity for monetary compensation for loss suffered to an owner by police power restriction arises when restrictions are placed on property in order to create a public benefit rather than to prevent a public harm. (Rathkopf, The Law of Zoning and Planning, Vol. 1, ch. 6, pp. 6-7.)

[10] This case causes us to reexamine the concepts of public benefit in contrast to public harm and the scope of an owner's right to use of his property. In the instant case we have a restriction on the use of a citizen's property, not to secure a benefit for the public, but to prevent a harm from the change in the natural character of the citizen's property. We start with the premise that lakes and rivers in their natural state are unpolluted and the pollution which now exists is man made. The state of Wisconsin under the trust doctrine has a duty to eradicate the present pollution and to prevent further pollution in its navigable waters. This is not, in a legal sense, a gain or a securing of a benefit by the maintaining of the natural *status quo* of the environment. What makes this case different from most condemnation or police power zoning cases is the interrelationship of the wetlands, the swamps and the natural environment of shorelands to the purity of the water and to such natural resources as navigation, fishing, and scenic beauty. Swamps and wetlands were once considered wasteland, undesirable, and not picturesque. But as the people became more sophisticated, an appreciation was acquired that swamps and wetlands serve a vital role in nature, are part of the balance of nature and are essential to the purity of the water in our lakes and streams. Swamps and wetlands are a necessary part of the ecological creation and now, even to the uninitiated, possess their own beauty in nature.

[11,12] Is the ownership of a parcel of land so absolute that man can change its nature to suit any of his purposes? The great forests of our state were stripped on the theory that man's ownership was unlimited. But in forestry, the land at least was used naturally; only the natural fruit of the land (the trees) were taken. The despoilage was in the failure to look to the future and provide for the reforestration of the land. An owner of land has no absolute and unlimited right to change the essential natural character of his land so as to use it for a purpose for which it was unsuited in its natural state and which injures the rights of others. The exercise of the police power in zoning must be reasonable and we think it is not an unreasonable exercise of that power to prevent harm to public rights by limiting the use of private property to its natural uses.

[13] This is not a case where an owner is prevented from using his land for natural and indigenous uses. The uses consistent with the nature of the land are allowed and other uses recognized and still others permitted by special permit. The shoreland zoning ordinance prevents to some extent the changing of the natural character of the land within 1,000 feet of a navigable lake and 300 feet of a navigable river because of such land's interrelation to the contiguous water. The changing of wetlands and swamps to the damage of the general public by upsetting the natural environment and the natural relationship is not a reasonable use of that land which is protected from police power regulation. Changes and filling to some extent are permitted because the extent of such changes and fillings does not cause harm. We realize no case in Wisconsin has yet dealt with shoreland regulations and there are several cases in other states which seem to hold such regulations unconstitutional; but nothing this court has said or held in prior cases indicate that destroying the natural character of a swamp or a wetland so as to make that location available for human habitation is a reasonable use of that land when the new use, although of a more economical value to the owner, causes a harm to the general public.

[14, 15] Wisconsin has long held that laws and regulations to prevent pollution and to protect the waters of this state from degradation are valid police power enactments. . . . The active public trust duty of the state of Wisconsin in respect to navigable waters requires the state not only to promote navigation but also to protect and preserve those waters for fishing, recreation, and scenic beauty. . . . To further this duty, the legislature may delegate authority to local units of the government, which the state did by requiring counties to pass shoreland zoning ordinances. . . .

[16, 17] This is not a case of an isolated swamp unrelated to a navigable lake or stream, the change of which would cause no harm to public rights. Lands adjacent to or near navigable waters exist in a special relationship to the state. They have been held subject to special taxation, . . . and are subject to the state public trust powers; . . . and since the Laws of 1935, ch. 303, counties have been authorized to create special zoning districts along waterways and

zone them for restrictive conservancy purposes.[5] The restrictions in the Marinette County ordinance upon wetlands within 1,000 feet of Lake Noquebay which prevent the placing of excess fill upon such land without a permit is not confiscatory or unreasonable.

. . . .

The Justs rely on several cases from other jurisdictions which have held zoning regulations involving flood plain districts, flood basins and wetlands to be so confiscatory as to amount to a taking because the owners of the land were prevented from improving such property for residential or commercial purposes. While some of these cases may be distinguished on their facts, it is doubtful whether these differences go to the basic rationale which permeates the decision that an owner has a right to use his property in any way and for any purpose he sees fit. In Dooley v. Town Plan & Zon. Com. of Town of Fairfield (1964), 151 Conn. 304, 197 A.2d 770, the court held the restriction on land located in a flood plain district prevented its being used for residential or business purposes and thus the restriction destroyed the economic value to the owner. The court recognized the land was needed for a public purpose as it was part of the area in which the tidal stream overflowed when abnormally high tides existed, but the property was half a mile from the ocean and therefore could not be used for marina or boathouse purposes. In Morris County Land I. Co. v. Parsippany-Troy Hills Tp. (1963), 40 N.J. 539, 193 A.2d 232, a flood basin zoning ordinance was involved which required the controversial land to be retained in its natural state. The plaintiff owned 66 acres of a 1,500-acre swamp which was part of a river basin and acted as a natural detention basin for flood waters in times of very heavy rainfall. There was an extraneous issue that the freezing regulations were intended as a stop-gap until such time as the government would buy the property under a flood-control project. However, the court took the view the zoning had an effect of preserving the land as an open space as a water-detention basin and only the government or the public would be benefited, to the complete damage of the owner.

In State v. Johnson (1970), Me., 265 A.2d 711, the Wetlands Act restricted the alteration and use of certain wetlands without permission. The act was a conservation measure enacted under the police power to protect the ecology of areas bordering the coastal waters. The plaintiff owned a small tract of a salt-water marsh which was flooded at high tide. By filling, the land would be adapted for building purposes. The court held the restrictions against filling constituted a deprivation of a reasonable use of the owner's property and, thus, an unreasonable exercise of the police power. In MacGibbon v. Board of Appeals of Duxbury (1970), 356 Mass. 635 255 N.E.2d 347, the plaintiff owned seven acres of land which were under water about twice a month in a shoreland area. He was denied a permit to excavate and fill part of his property. The purpose of the ordinance was to preserve from despoilage natural features and resources such as salt marshes, wetlands, and ponds. The court took the view the preservation of privately owned land in its natural, unspoiled state for the enjoyment and benefit of the public by preventing the owner from using it for any practical purpose was not within the limit and scope of the police power and the ordinance was not saved by the use of special permits.

[18] It seems to us that filling a swamp not otherwise commercially usable is not in and of itself an existing use, which is prevented, but rather is the preparation for some future use which is not indigenous to a swamp. Too much stress is laid on the right of an owner to change commercially valueless land when that change does damage to the rights of a public. It is observed that a use of special permits is a means of control and accomplishing the purpose of the zoning ordinance as distinguished from the old concept of providing for variances. The special permit technique is now common practice and has met with judicial approval, and we think it is of some significance in considering whether or not a particular zoning ordinance is reasonable.

A recent case sustaining the validity of a zoning ordinance establishing a flood plain district is Turnpike Realty Company v. Town of Dedham (June, 1972), 72 Mass. 1303, 284 N.E.2d 891. The court held the validity of the ordinance was supported by valid considerations of public welfare, the conservation of "natural conditions, wildlife and open spaces." The ordinance provided that lands which were subject to seasonal or periodic flooding could not be used for residences or other purposes in such a manner as to endanger the health, safety or occupancy thereof and prohibited the erection of structures or buildings which required land to be filled. This case is analogous to the instant facts. The ordinance had a public purpose to preserve the natural condition of the area. No change was allowed which would injure the purposes sought to be preserved and through the special-permit technique, particular land within the zoning district could be excepted from the restrictions.

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[5] In Jefferson County v. Timmel (1952), 261 Wis. 39, 51 N.W.2d 518, the constitutionality of a conservancy district use restriction was upheld as being based on a valid exercise of police power. The purpose for this conservancy district, however, was for highway safety and not for the prevention of pollution and the protection of the public trust in navigable waters.

[19] The Justs argue their property has been severely depreciated in value. But this depreciation of value is not based on the use of the land in its natural state but on what the land would be worth if it could be filled and used for the location of a dwelling. While loss of value is to be considered in determining whether a restriction is a constructive taking, value based upon changing the character of the land at the expense of harm to public rights is not an essential factor or controlling.

We are not unmindful of the warning in Pennsylvania Coal Co. v. Mahon (1922), 260 U.S. 393, 416, 43 S.Ct. 158, 160, 67 L.Ed. 322: ". . . We are in danger of forgetting that a strong public desire to improve the public condition is not enough to warrant achieving the desire by a shorter cut than the constitutional way of paying for the change."

This observation refers to the improvement of the public condition, the securing of a benefit not presently enjoyed and to which the public is not entitled. The shoreland zoning ordinance preserves nature, the environment, and natural resources as they were created and to which the people have a present right.[6] The ordinance does not create or improve the public condition but only preserves nature from the despoilage and harm resulting from the unrestricted activities of humans.

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[6] On the letterhead of the Jackson County Zoning and Sanitation Department, the following appears: "The land belongs to the people . . . a little of it to those dead . . . some to those living . . . but most of it belongs to those yet to be born. . ."

Conflicts Yet Unborn

I thought, We have geared the machines and locked all
together into interdependence; we have built the
great cities; now
There is no escape. We have gathered vast populations
incapable of free survival, insulated
From the strong earth, each person in himself helpless, on
all dependent. The circle is closed, and the net
Is being hauled in . . .

Robinson Jeffers

Conflicts Yet Unborn

Richard F. Babcock and Fred P. Bosselman

Land use law is society's technique for preventing or resolving conflicts between various ways of using land. As the future brings new ways of using land it will bring new conflicts, which in turn will require changes in our system of land use law.

In the past such changes have all too often taken place without conscious forethought. After a new way of using land is developed the legal rules that seem most analogous are stretched, squeezed or bent to adapt to the changed conditions. But if we examine prospective changes in our ways of using land well in advance, it will often be possible to custom-tailor new legal institutions to society's real needs.

This paper discusses three possible changes in our future ways of using land and examines the impact of these changes on the legal system. Neither the desirability nor the inevitability of these changes is at issue here. All have been widely discussed as possibilities, and the likelihood of their occurrence is at least sufficient to justify examination of the consequences for the legal system.

Control of Migration

Since the Articles of Confederation our government has been based on the proposition that "We are all citizens of the United States; and as members of the same community, must have the right to pass and repass through every part of it without interruption, as freely as in our own states."[1] The right of each part of the country to compete to attract industries and offices and dams and air-bases is a deeply ingrained element of our political system.

Conversely, our system recognizes that no part of the country has any direct power to prevent other citizens of the United States from immigrating. Attempts by the states to limit the migration of welfare recipients have been thrown out by the courts repeatedly.

The United States is not atypical in its experience. The English have failed to stop southeast migration from Glasgow to London. As the Meyersons have pointed out, "no country, even the authoritarian Soviet Union, has successfully limited the size of population-magnet cities."[2] The shantytowns outside Brasilia bear witness to the failure of present systems.

This paper was prepared for a Conference sponsored by the National Science Foundation held in Boulder, Colorado, July 23 to August 4, 1972. The full text of the paper will appear in *Environment: A New Focus for Land Use*, edited by Donald McAllister, to be published by the National Science Foundation.

[1] Passenger Cases, 7 How. (48 U.S.) 283, 492.

[2] Martin and Margy Meyerson, "Some Questions About Enhancing the Quality of the Urban Environment," in *The Future of the United States Government*, H. Perloff, ed., 327, 333 (1971).

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Our increasing awareness of the interrelated elements of our environment is leading many to conclude, however, that the carrying capacity of the ecosystems of many areas of the country have already been exceeded. It is conceivable that our constitutional traditions must give way to an environmental crisis. At least Dr. Commoner suggests that "whatever stands in the way of the necessary accommodation to the ecological imperative. . . will need to abdicate its immunity from change."[3]

Assuming that new legal rules to control migration are demanded, how will they develop? If they develop incrementally they will probably take the form of controls over the use of land analogous to those by which we now limit portions of metropolitan areas to members of upper income groups. By direct or indirect means whole regions of the country might be reserved for the upper classes, with necessary low-paid workers bussed in and out like South African gold miners.

But if we were to devise a different system of controlling migration--assuming for purposes of argument that it must be controlled--how would we do it? To allow local areas to choose their own methods of limiting migration would inevitably favor existing residents. Thus a national system of regulation seems inevitable. But with what criteria?

Let us assume that the national government concludes that South Florida can support only its present level of population rather than the doubling of it that is currently predicted. How do we choose who gets to live in Miami? Only those over 65? Do we choose a cross-section of ethnic groups? Do we try to match talents to jobs? Is it first-in, last-out?

This exercise in devising a legal system for controlling migration is not pure whimsy. If, as we suspect, it results in demonstrating that all of the potential methods of controlling migration portend horrendous social consequences, it will demonstrate that any "ecological imperative" which requires this type of control had better be pretty damned imperative!

The Law of the Megastructure

A more appealing alternative to the crisis foreseen for overcrowded urban areas is the creation of new systems of urban living at high densities that minimize environmental problems. Various proposals for such systems have been put forth in recent years, cities domed or subterranean, floating or sunken, all lumped for purposes of this discussion in the category "megastructures."

All megastructures have a common emphasis on a three-dimensional element. Activities would be pursued on a multitude of vertical levels. This requires a number of changes in basic legal theories.

Traditionally the common law visualized land for commodity purposes as the surface of the earth together with the ground beneath down to the center of the earth and the air above to infinity. The man who owned the surface owned all that was above and below.

Technological developments have brought changes in this concept, but they have come about incrementally, through the creation of exceptions to the traditional rules, and for the most part these exceptions have proven an unsatisfactory method of dealing with the problem. For example, the respective rights of airplanes and landowners near airports are still in a state of considerable confusion.

With the coming of the megastructure the idea of relating an individual's "ownership" interest to a specific portion of the earth's surface becomes completely absurd. If we assume that the idea of property ownership is worth preserving how can we find new methods of identifying the property being owned and specifying the rights and responsibilities of ownership. Can the occupant of cubicle 362 on level 26 of complex alpha be given the same incentive toward assuming a responsibility for the maintenance of his dwelling that present homeowners apparently receive from the concept of homeownership?[4] Can the law governing a condominium be expanded to encompass a whole city?

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[3] Barry Commoner, *The Closing Circle* 281 (1971).

The megastructure should also force a reexamination of the law governing the control of communal function--streets, parks, utilities, etc. The use of analogies to existing systems is not a sensible way to determine whether passageway B on level 15 is a "street" that must be swept by the municipal government or a "private" corridor to be maintained by a private individual or by some mini-goverment. Does the electric company have the legal obligation and right to deliver power to each dwelling or just to the megastructure "gate"? Only a new approach to traditional ideas of law can resolve such issues sensibly.

The importance of taking a fresh look at these issues is accentuated by our increasing knowledge of the ramifications of environmental psychology. As we understand more of the different psychological impacts caused by subtle changes in the physical characteristics of high density living we may find an increasing need for new controls based on criteria unimaginable ten years ago. As we begin to understand that what Robert Sommer has called "the ecology of privacy"[5] may be significantly affected by whether a door opens out or in or whether a barrier is five feet high or six, we may see the need to adopt wholly new forms of regulation of the use of land, particularly in the high density environment of the megastructure.

And even if the more advanced forms of enclosed cities are never built, a reexamination of legal concepts based on the megastructure model may produce innovations that would prove useful in more immediate situations. The legal relationship of the developer of a new town, residents of the surrounding area, and future residents of the new town, is at present muddled, and might benefit from this type of research.

Changing Concepts of Family

One of the most prominent features of the counter-culture movement is its rebellion against the concept of the unitary family and traditional methods of rearing children. New forms of communalism are flourishing. Tolerance is expressed for a wide variety of relationships between people of different age and sex as alternatives to the traditional man-wife parent-child pattern.

Whether these trends will or should continue is beyond the scope of this paper, as is the substantial changes in the law of domestic relations--marriage, divorce, adoption, etc.--that would be needed to legitimize a variety of alternatives to the the traditional family. But our land laws also revolve around the traditional family concept in more ways than one might realize.

The laws governing the inheritance of land, while somewhat more flexible than in the days of primogeniture, still are based largely on each individual's place is the traditional family hierarchy. So with such other legal institutions as dower, community property, and homestead exemptions.

The law of zoning uses the traditional family unit as its modular. From the simplest protection of the "single-family" home to the most complex density coefficient ratio all residential zoning assumes one traditional mom-and-pop family in each dwelling unit. Where the system is challenged, whether by a haggle of hippies, a piety of priests, or an exemplar of ex-addicts, the system proves unadaptable.

If greater flexibility in the concept of family is to be encouraged we will need to revise our laws governing the disposition and use of real property to remove the handicaps it now places on any attempt to share property in ways not officially sactioned by our forefathers.

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[4] See George Sternlieb, *The Tenement Landlord* 174 (1966)

[5] Robert Sommer, "The Ecology of Privacy," in H. M. Proshansky, W. H. Ittelson, and L. G. Rivlin, *Environmental Psychology: Man and His Physical Setting* 256 (1970).

These three examples are merely illustrative of the way in which new ways of using land demand reexamination of existing legal rules. Even if the new uses of land never come about, however, the insight offered by the examination of traditional land use laws from a new perspective may open the way for progressive reforms.